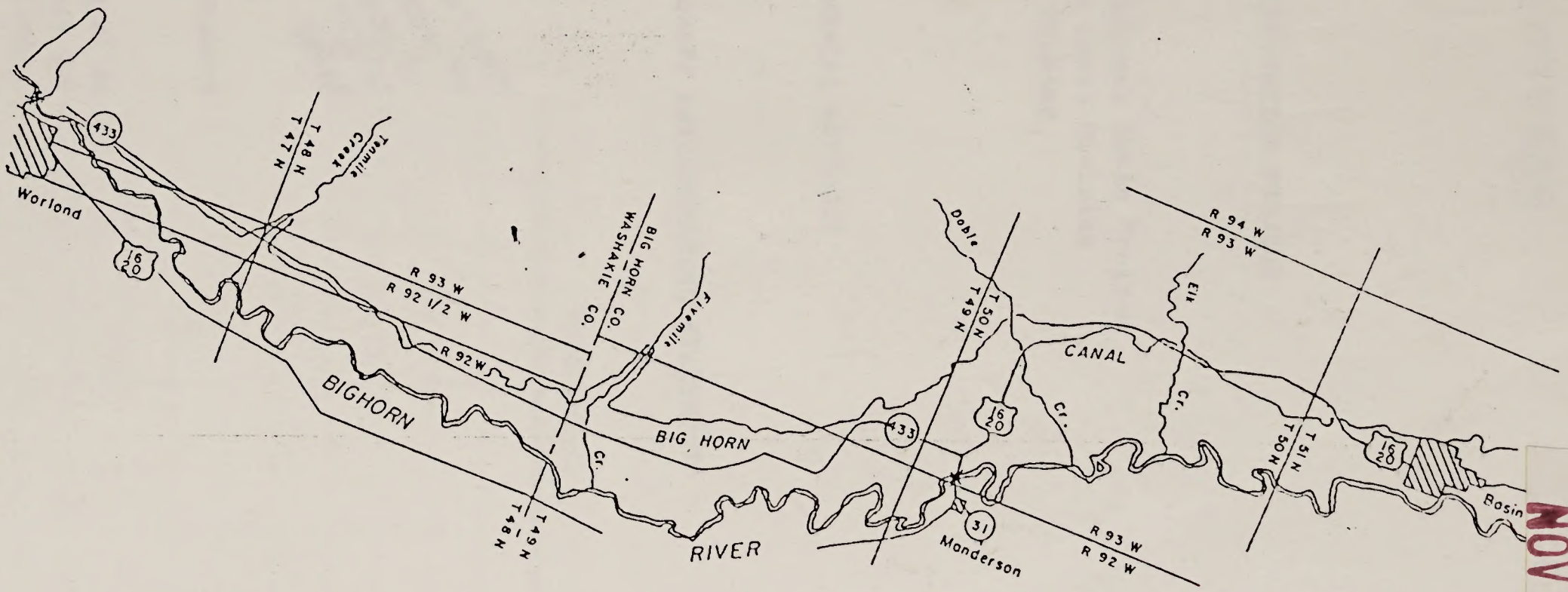
WESTSIDE IRRIGA
PROJECT

BIG HORN BASIN DIVISION
PICK-SLOAN MISSOURI BASIN PROGRAM
WYOMING

ENVIRONMENTAL APPENDIX



PARTMENT OF THE INTERIOR

OF RECLAMATION
BASIN REGION
MONTANA

A OF LAND MANAGEMENT
SS CREEK RESOURCE AREA
RLAND, WYOMING

STATE OF WYOMING

WYOMING WATER DEVELOPMENT
COMMISSION
CHEYENNE, WYOMING

WESTSIDE IRRIGATION PROJECT

Pick-Sloan Missouri Basin Program
Big Horn Basin Division
Wyoming

ENVIRONMENTAL APPENDIX

TO

THE PLANNING REPORT/DRAFT ENVIRONMENTAL STATEMENT

Prepared By:

Bureau of Reclamation
Missouri Basin Region
Billings, Montana

Contents

SECTION 1

ENVIRONMENTAL QUALITY ANALYSIS

Environmental Quality (EQ) Account

Surface Water Quantity and Quality.--Big Horn River flows are sufficient in many years to meet the annual needs of the Preferred Plan (see the EQ Table). In years where this would not be the case, releases would be made from Boysen Reservoir. These releases would be to replace Westside diversions whenever flows in the river were 380 ft^3/s or less at Worland, resulting in no water quantity impacts attributable to the Westside Project.

Water quality constituents (TDS, trace constituents/metallic elements, and pesticides) in the Big Horn River were determined to increase slightly with the project but would pose no threat to human or aquatic species, based on published standards. Sediment reaching the Big Horn River from the project area is estimated to increase by 16 tons/year (9 percent higher than present). This increase is judged to be insignificant on turbidity and aquatic species in comparison to the present condition (see EQ Table).

Ground Water Quantity and Quality.--Ground water in the project area is of limited quantity (up to 15 gpm) and poor quality (up to 1,590 ppm TDS). The Preferred Plan would add approximately 3,600 acre-feet of ground water inflow until project drains were installed, after which time the quantity per year would be approximately 1,500 acre-feet (see EQ Table). This quantity increase would have no significant effect on the area as ground water is not widely used due to low yields.

The only anticipated significant project effect on ground water quality is an increase in iron levels (mean concentration of 1,492 ppb) which presently exceeds the Federal Primary or Secondary Drinking Water Standards of 300 ppb (see EQ Table). At these projected concentrations, water would be unappealing and unpalatable. As little use is presently made of ground water due to poor quality no significant effects are anticipated and no mitigation planned.

Fisheries.--Based on the surface water quantity analyses, there would be no effects on the Big Horn River fishery. Water quality changes would be insignificant and therefore would not affect the fishery.

ENVIRONMENTAL FACTOR	PRESENT CONDITION	FUTURE W/O PROJECT (NO-ACTION ALTERNATIVE)	PREFERRED PLAN 1/	SIGNIFICANCE 2/
Surface Water Quantity: (Big Horn River)	Unappropriated flows available through early summer in average years.	Same as present.	Unappropriated flows used to meet project needs when available (15,400 acre-feet). When flows are 580 ft^3/s or less at the Bighorn Canal headgate releases would be made from Boysen Reservoir to replace Westside diversions.	0
Surface Water Quality: (Big Horn River)				
TDS	649 ppm	649 ppm	653 ppm	0
Arsenic	8.550 ppb	8.550 ppb	8.551 ppb	0
Cadmium	0.24000 ppb	0.24000 ppb	0.24005 ppb	0
Iron	72.49 ppb	72.49 ppb	72.66 ppb	-
Selenium	2.2000000 ppb	2.2000000 ppb	2.2000152 ppb	0
Pesticides:				
Carbaryl	Not Known	Not Known	0.00016 ppm	0
Dicamba	Not Known	Not Known	0.002 ppm	0
Aldicarb	Not Known	Not Known	0.025 ppm	0
Sediment Load	156 tons/year	156 tons/year	172 tons/year	0
Phosphorus	Not Known	Not Known	0.65 ppm	0
Nitrates/Nitrites	Not Known	Not Known	2.535 ppm	0
Ground Water Quantity:	Existing wells downslope of project area have limited capacity (up to 15 gpm)	Same as present.	No change except seepage and deep percolation will add to ground water supplies.	0
Ground Water Quality:	Generally of poor quality (up to 1,590 ppm TDS)	Same as present.	Projected levels for iron (mean value of 1,492 ppb) would exceed Federal Primary or Secondary Drinking Water Standard of 300 ppb, causing water to be unappealing and unpalatable.	-
Fisheries:	Being maintained by present flows and/or reservoir elevations/ storage.	Same as present.	No change. Westside diversions will be replaced by releases from Boysen Reservoir, when necessary.	0
Wildlife:				
Crucial Winter Range - Acres	Approximately 94,100 acres of crucial winter range occur within the range of the Fifteenmile Antelope Herd unit.	Same as present.	Development of Preferred Plan would result in loss of 4,302 acres of antelope crucial winter range.	-
Crucial Winter Range - Sagebrush biomass	An estimated 1,088,300 pounds of forage exist on lands that would be irrigated.	Same as present.	The forage (sagebrush) on lands to be irrigated would be lost, but would be replaced through changes in grazing allotments.	0
Depredation	N/A - Public rangeland	Same as present.	Depredation claims would be paid from a fund established by irrigators.	0
Soil Erosion:	Estimated losses are 0.38 tons per acre.	Same as present.	Soil losses are estimated to increase to an average of 4.0 tons per acre, ranging from .01 ton per acre for alfalfa to 9.7 tons per acre for sugar beets.	- -
Land Use:				
Acreage	4,693 acres of 4,950 acres in project boundaries are public rangeland. Over 2,000,000 acres of public land occur in two-county area.	Same as present.	4,693 acres of public rangeland would be converted to privately owned irrigated cropland.	0
Public Access	Unlimited access to public land.	Same as present.	OMA's to mitigate for loss of recreation.	0
Livestock Grazing:	Predominant use of public land in the area is grazing of cattle and sheep.	Same as present.	Project development would eliminate four grazing allotments for 2,309 AUMs. Additional allotments would be modified to provide antelope crucial winter range mitigation.	-
Cultural Resources:	234 archeological sites in project boundaries with 800 acres yet to be surveyed.	Sites would continue to exist with some degradation due to natural forces.	At least 20 sites would be disturbed by project construction but would be mitigated by excavation and/or data recording.	-
Total EQ Effect 1/		0	-	
Rank Order of Plan		1	2	

1/ Compared to the future condition.

2/
- \- Minor adverse
- \- - Moderate adverse
- \- - - Highly adverse
- 0 No significant effect
- \+ + + Highly beneficial
- \+ + Moderately beneficial
- \+ Slightly beneficial

Wildlife.--The lands proposed for irrigation development presently support stands of sagebrush, classified as crucial antelope winter range by the WGFD. Crucial winter range is highly valued for its high productivity, the fact that it stays snow-free and the excellent cover it provides for fawning. A mitigation plan to compensate for losses of 4,302 acres of crucial winter range for antelope has been developed. The basic concept of the winter range mitigation plan is to increase forage production on non-project areas through the adjustment or modification of existing grazing leases. With the project the total amount of forage available would be the same as at present, albeit on a smaller total acreage. For these reasons, mitigation will be in place before construction.

The Wyoming Game and Fish Department has expressed concern over potential game animal depredation claims which, by law, they are responsible for. A fund would be established and funded by the irrigators to pay any claims on project land.

Soil Erosion.--Soil losses due to wind and water are expected to be slight (0.38 tons per acre) without the project. Construction of the project would significantly increase losses to an average of 4 tons per acre, based on the assumed crop rotation of malt barley, sugar beets, alfalfa and irrigated pasture.

Land Use.--The Westside Project would change land ownership of 4,693 acres of public rangeland; 4,068 of these acres would be converted to irrigated cropland. The land is presently used for grazing, wildlife, recreation, and petroleum exploration. Also, permitted grazing uses would be modified on other allotments (the number and acreages as yet undetermined) to provide the necessary improvements in forage (sagebrush) production to achieve mitigation for antelope crucial winter range.

To compensate for lost recreation and small and nongame habitat in the project area, 406 acres would be retained in public ownership to be managed as CMA's.

Livestock Grazing.--The project includes parts of four grazing allotments leased by BLM, with a total of 2,309 AUMs (animal unit months, i.e., the forage necessary to support 1 mature cow, with or without calf, for 1 month).

The Preferred Plan would cause the loss of grazing on 4,693 acres of public rangeland, which could lead to the cancellation of grazing over an entire allotment, even though only a part of the allotment were affected. Range improvements and cattle watering access points would be lost along with the cancellation of an allotment.

Further reductions in grazing would occur on non-project allotments to achieve mitigation for antelope crucial winter range. Grazing allotments would be changed to provide 4,115 AUM's.

The four allotments that would be affected by project development are operated by landowners who would receive irrigation. Allotments affected as a result of antelope winter range mitigation, and associated negotiations, would be the responsibility of the irrigation district.

Cultural Resources.--There are 234 archeological sites in the project area which could be eligible for the National Register of Historic Places. At least 20 sites would be affected by the project. About 800 acres remain to be surveyed.

Final surveys, testing, and any required mitigation, would be completed before construction under 36 CFR 800, the National Historic Preservation Act of 1966 (as amended), and Reclamation Instructions 376.11.

Other factors that were evaluated, but were determined to not be significantly affected, were mineral resources, air quality, prime or unique farmlands, and energy.

SECTION 2

METHODS

The U.S. Fish and Wildlife Service's Mitigation Policy (Federal Register Volume 46, Number 15, Pages 7644-7663; January 23, 1981), which established Resource Categories, Designation Criteria and Mitigation Planning Goals for habitat values which may be impacted by project development, was used to rate the value of the habitats on the Westsid Project area. The evaluation categories:

Resource Category	Designation Criteria	Planning Goal
1	High value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value.
2	High value for evaluation species and scarce or becoming scarce.	No net loss of in-kind habitat value.
3	High to medium value for evaluation species and abundant.	No net loss of habitat value while minimizing loss of in-kind habitat value.
4	Medium to low value for evaluation species.	Minimize loss of habitat value.

Terrestrial

Terrestrial wildlife resources in the Westside Project have been monitored by WGFD and Bureau of Land Management (BLM) personnel for a number of years. Data from the big surveys for antelope in Hunt Area 77 and mule deer in Hunt Area 125 recorded on the WGFD computer-based Wildlife Observation system were sued to summarize population numbers and

distribution on the Westside Project area. Sage grouse leks and wintering areas were pinpointed using WGFD and BLM overlays. Waterfowl numbers and concentration areas on the Bighorn River were derived from WGFD surveys. Nongame birds and mammal species lists and the locations of prairie dog towns were compiled from BLM and WGFD survey information.

Habitat type mapping presented in this analysis was complete utilizing BLM 1:24,000 scale Site Write-up Area (SWA) maps which delineate range sites. Vegetative composition on the range sites was derived from the Soil Vegetation Inventory Method (SVIM) inventory of the Grass Creek Resource Area. The WGFD inventory 1984 report entitled "Westside Irrigation Project - Reconnaissance Level Terrestrial Wildlife Impact Report" (Luce 1984) detailed the relative value of the habitats which will be impacted by the project.

The Wyoming Game and Fish Department has prepared vegetation overlays of the project area so the distribution and acreage of habitat types important to wildlife can be compared to the proposed irrigated land development plan.

Information on bald eagle winter roosting and concentration areas along the Bighorn River; and data on the Basin bald eagle nest were derived from the USFWS publication, "Bald Eagle Essential Habitat on or near Bureau of Land Management Lands in Wyoming" (Jenkins 1980), and WGFD publications including: the draft Bald Eagle Recovery Plan (Oakleaf in press); "Inventories of Nesting Bald Eagles and Osprey in Wyoming" (Squires and Oakleaf 1979), and "Raptor Habitat Study on State and Private Lands" (Oakleaf 1979). Data assimilated by WGFD and BLM during mid-winter bald eagle surveys are also summarized.

Fisheries

Fishery data used for determining potential impacts were obtained from existing records maintained by WGFD. Potential impacts to the river fishery between Boysen and the Bighorn Canal diversion were based on a WGFD study by Annear and Conder (1981). In this study, a physical habitat

simulation model (IFG-4) developed by the U.S. Fish and Wildlife Service (USFWS) (Bovee and Milhous 1978) was used to quantify habitat for juvenile rainbow trout over a range of flows. The effect of various late summer flows on adult trout habitat quality (and standing crop) was determined using the Habitat Quality Index (HQI) (Binns and Eiserman 1979). Results from this model are expressed in habitat units (HU) which are defined as the amount of habitat quality necessary to produce a one-unit change in trout standing crop. In well-established fisheries where trout are able to complete all phases of their life cycle the measured population density normally approximates the number of HU's in the stream. The model is used to estimate potential changes in HU's with changes in flow by measuring various habitat attributes at three or more different flows. The HQI was measured at 350 cubic feet per second (ft^3/s), 1,100 ft^3/s, and 1,400 ft^3/s. Estimates of HU dynamics outside this range of flows are not possible.

Maintenance flow (MF) recommendations for segment BHI were determined by computer analysis of hydraulic characteristics of critical riffles. The Tennant Method (Tennant 1976) was used to identify the MF recommendations for BH2 and BH3. The maintenance flow is defined as a continuous instream flow that is needed to maintain fish populations at their existing levels at any time during the year. Different (higher) flows may be needed at other times of year in order for certain species to complete their life cycle (e.g., spawning flows, rearing flows, etc.).

A preferred minimum fisheries pool recommendation for protecting the reservoir fishery was determined by analysis of reservoir storage contents and fishery reproduction and growth data for the life of the reservoir.

The term dewatering, as used in this report, refers to any additional removal of water from the Bighorn River and should not be interpreted to mean the removal of all flowing water from the river. Analyses are provided for average and worst case conditions. Average conditions refer to years when water supply is equal to or greater than flows in average water years. Worst case conditions refer to lower decile and/or below average water years.

Vegetation occurring on the project area was classified into four habitat types and catergorized under the USFWS Mitigation Policy. Due to the importance of riverine and reservoir habitats to terrestrial wildlife, it was also described and categorized.

1. Saltbrush - Nuttalls's saltbrush (Atriplex nuttallii) and shadscale saltbrush (Atriplex confertitolia). Occur on shale and saline upland range sites over most of the project lands. It seldom occurs in pure stands, usually being associated with big sagebrush. Many saltbrush stands are very sparse and contain more surface area of rock and rock outcrop than vegetative cover.

The dominant understory species associated with saltbrush are squirreltail (Sitanion hystrix) and birdfoot sage (Artemeasia Pedatifida).

Nuttall's saltbush is the most common habitat in Washikie and Bighorn Counties, and although browsed by mule deer and antelope at all seasons of the year, it is not considered an important component of critical antelope winter range nor mule deer winter range because of its low growth form. Use by nongame species is light. Golden and bald eagles forage in this habitat, and both white-tailed prairie dog towns in the project area are located in saltbush. This habitat type was classified as Resource Category 4 under USFWS Mitigation Policy.

2. Saltbrush - This habitat, which is found mostly on sandy and loamy soils, although rare in the counties, is the most common habitat type on the project area. A randomly selected sample plot showed the composition of the sagebrush stand to be approximatley 85 percent big sagebrush (Artemisia tridentrata) and 15 percent silver sagebrush (Artesmeasia cana). Other shrubs occurring in sagebrush stands include Nuttall's saltbrush and shadscale saltbrush. Underst_____ grasses consisted of downy brome (Bromeus tectorum), needle-and-thread grass (Stipa comata), Indian ricegrass (Oryzopsis hymenoides), blue grama (Bouteloua gracilis) and bluebunch wheatgrass (Agropyron spicatum). Saltbrush habitat is of high value of antelope, mule deer, and several nongame species including the golden eagle. Sagebrush, which is rare in this part of Washakie and Bighorn Counties, is restricted ...

is restricted to narrow band located primarily in the project area. All sagebrush in the project area is considered crucial antelope winter range. Due to its importance and rarity, this habitat type was classified as Resource Category 2 under the USFWS Mitigation Policy.

3. Grassland - Grassland habitat occurs mainly along the Bighorn Canal and in Fivemile Creek bottom. Wheatgrasses including western wheatgrass (Agropyron smithii), thickspike wheatgrass (Agropyron dasystachyum), and streambank wheatgrass (agropyron reparium)dominate near the canal and along Fivemile Creek while bottlebrush squirretail is found in the Fivemile Creek floodplain. Mule deer and antelope use this habitat primarily in sp ng when succulent forbs are abundant. Forgaging bald and golden eagles and few nongame species utilize the habitat yearlong. This habitat type was classified as Resource Category 4 under the USFWS Mitigation Policy.

4. Riparian - This habitat occurs along the Bighorn River, stock water reservoirs and some segments of tributary creeks. On Five and Tenmile Creeks, plains cottonwood (Populus deltoides) is present in sccattered, decadent stands. Livestock grazing was prevented regeneration in recent years, and most existing trees are at least partially dead. Creek bottoms below the Bighorn Canal and the reparian zone along the Bighorn River vegetated with plains cottonwood. Russian olive (Elaeagnus angustifolia), willow (Salix spp.) and Tamarisk (Tamarix spp.). Understory species include wild licorice (Glycyrrhiza spp.), yellow sweetclover (Melilotus officinalis), bluegrasses (Poa spp.) downy brome (Bromus tectorum) and annual and perennial thistles. Wetlands adjacent to the river support sedges (Carex spp.), cattail (Typha latifolia), bulrushers (Scirpus spp.) and wide variety of marsh plants. Approximately 30 miles of river bottom between the Bighorn Canal diversion and the mouth of Dobie Creek are included in this category.

Riparian habitat along the Bighorn River supports the widest variety of wildlife of any habitat in the project area. The river bottom and adjacent uplands along the river are mule deer crucial winter and yearlong range. Numerous species of nongame birds and mammals, including the endangered bald eagle, utilize the riparian zone yealong. The reparian zone along Tenmile and Fivemile creeks, consisting of scattered cottonwoods above the

Bighorn Canal, has a species diversity similar to that described for the Bighorn River in areas below the canal where seep from the canal provides moisture during the growing season. This important habitat for wildlife was classified as Resource Category 2 under the USFWS Mitigation Policy.

5. Riverine habitat - The Bighorn River is a large lotic habitat providing habitat for fish, aquatic furbearers, shorebirds and water fowl. Maintenance flows in the river is important for retention of aquatic habitat values and the adjacent riparian zone. This habitat type was classified as Resource Category 2 under the USFWS Mitigation Policy.

6. Reservoir habitat - Boysen Reservoir provides yearlong habitat for ducks Canada geese, and is an important Canada goose productiohn area. The most important habitat on the reservoir consists of nesting islands in Cottonwood Bay and along the west shoreline. This habitat type was classified as Resource Category 3 under the USFWS Mitigation Policy.

SECTION 3

WILDLIFE MAPS AND SPECIES LISTS

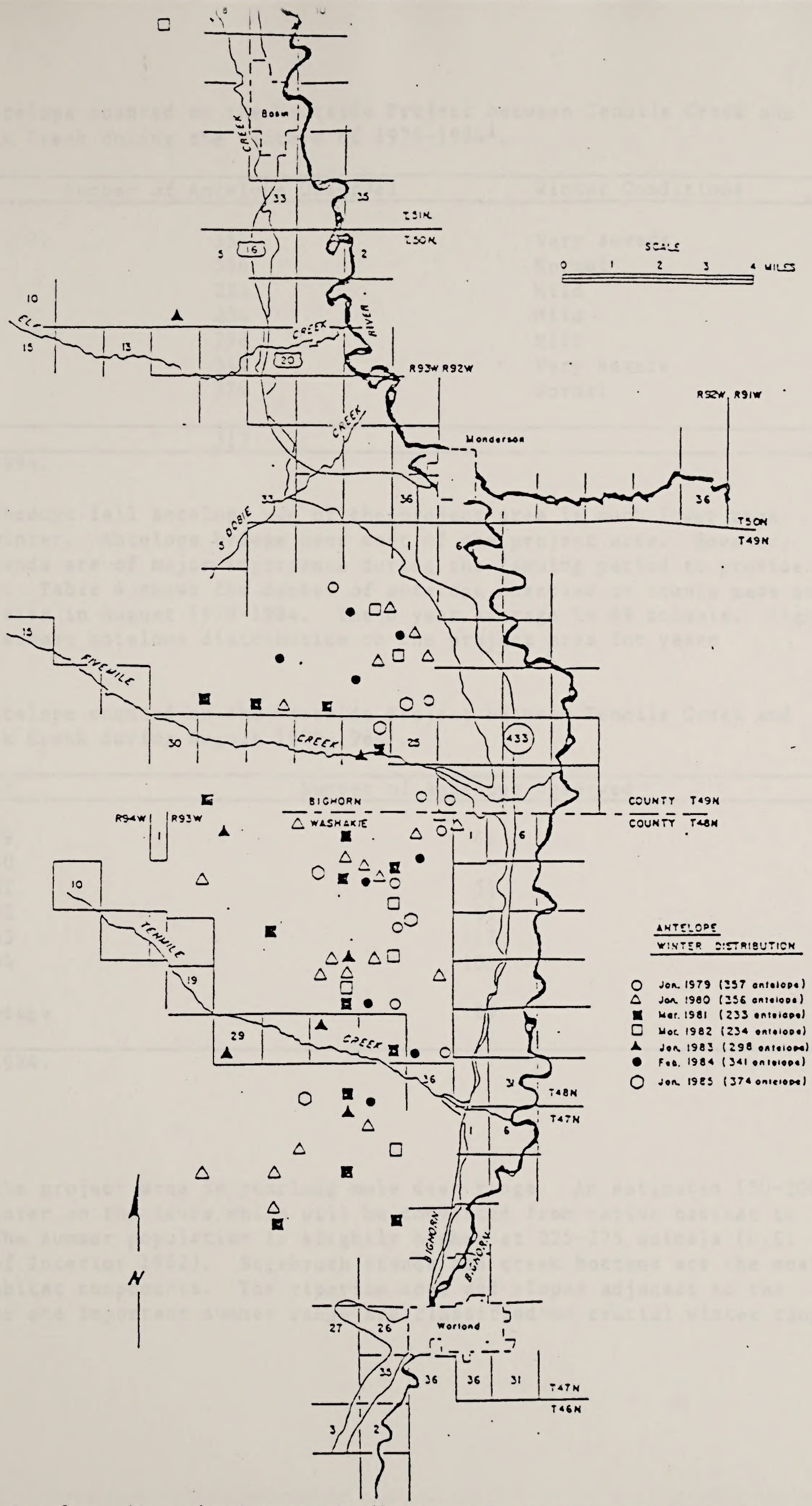


Figure 2. Antelope distribution on the Westside Irrigation project area during the winters of 1979-1980 through 1984-1985.

Table 3. Antelope counted on the Westside Project between Tenmile Creek and Elk Creek during the winters of 1978-1984[1].

Year	Number of Antelope Observed	Winter Conditions
1978-79	357	Very severe
1979-80	356	Normal
1980-81	233	Mild
1981-82	234	Mild
1982-83	298	Mild
1983-84	341	Very severe
1984-85	374	Normal
Average	313	

[1] Thompson 1984.

Spring through fall antelope use of the project area is much lower than during the winter. Antelope browse over most of the project area. However, sagebrush stands are of major importance during the fawning period to provide hiding cover. Table 4 shows the number of antelope observed on counts made on the project area in August 1979-1984. The 6 year average is 89 animals. Figure 3 shows the summer antelope distribution on the project area for years 1978-1984.

Table 4. Antelope counted on the Westside Project between Tenmile Creek and Elk Creek during August 1979-1984[1].

Year	Number of Antelope Observed
1979	61
1980	-
1981	52
1982	81
1983	147
1984	106
Average	89

[1] Thompson 1984.

Mule Deer

All of the project area is yearlong mule deer range. An estimated 150-200 mule deer winter on the lands which will be converted from native habitat to cropland. The summer population is slightly higher at 225-275 animals (U.S. Department of Interior 1982). Sagebrush stands and creek bottoms are the most important habitat components. The riparian zone and slopes adjacent to the Bighorn River are important summer range and classified as crucial winter range.

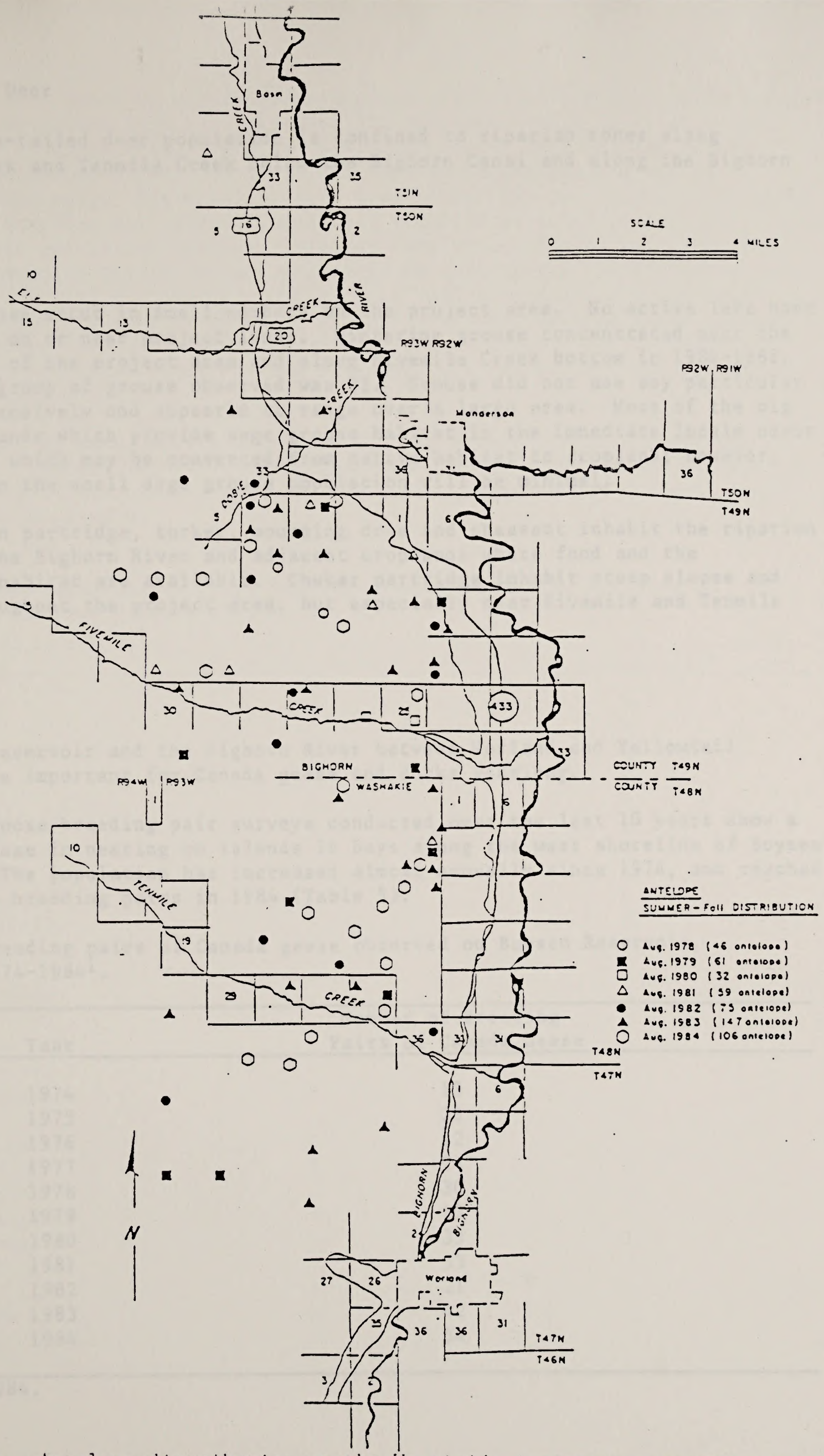


Figure 3. Antelope distribution on the Westiside irrigation project area during the summers of 1978-1984.

White-tailed Deer

The white-tailed deer population is confined to riparian zones along Fivemile Creek and Tenmile Creek below the Bighorn Canal and along the Bighorn River.

Game Birds

Sage grouse occur in small numbers on the project area. No active leks have been located on or near project lands. Wintering grouse concentrated near the northern end of the project area and along Fivemile Creek bottom in 1984-1985. The largest group of grouse observed was 23. Grouse did not use any particular location extensively and appeared to range over a large area. Most of the big sagebrush stands which provide sage grouse habitat in the immediate locale occur on the lands which may be converted from native habitat to cropland; however, the impact to the small sage grouse population will be minimal.

Hungarian partridge, turkey, mourning dove and pheasant inhabit the riparian zone along the Bighorn River and adjacent croplands where food and the appropriate habitat are available. Chukar partridge inhabit steep slopes and bottoms throughout the project area, but especially near Fivemile and Tenmile Creeks.

Waterfowl

Boysen Reservoir and the Bighorn River between Worland and Yellowtail Reservoir are important for Canada geese and ducks yearlong.

Canada goose breeding pair surveys conducted over the last 10 years show a steady increase in nesting on islands in bays along the west shoreline of Boysen Reservoir. The population has increased almost annually since 1974, and reached a high of 54 breeding pairs in 1984 (Table 5).

Table 5. Breeding pairs of Canada geese observed on Boysen Reservoir, 1974-1984[1].

Year	Number of Breeding Pairs of Canada Geese
1974	13
1975	23
1976	12
1977	24
1978	30
1979	13
1980	33
1981	33
1982	21
1983	42
1984	54

[1] Serdiuk 1984.

Canada goose breeding ground surveys along the Westside Project Area between Worland and Manderson from 1977 through 1982 recorded a high of 28 breeding pairs on the river in 1982. Twenty-one breeding pairs were counted between Manderson and Basin in 1982 and a similar density exists all the way to Yellowtail Reservoir. The trend in this area since 1965 has been a 6-12% annual increase in breeding pair density, and this trend is expected to continue. Most of these geese are island nesters. However, the 20 artificial nest structures between Thermopolis and Yellowtail Reservoir have attracted nesting geese, and there is a potential for installation of more nest structures. Brood-rearing takes place along the entire Westside project area, but favored areas are near grazed pastures, hayland and shallow, marshy areas adjacent to the river. Approximately 400 geese winter on the river between Worland and Basin, mainly around Manderson.

Duck breeding pair density along the Bighorn River between Worland and Manderson is 3.66/square mile - the highest density observed in the Bighorn Basin (Table 6). Approximately 300 to 500 ducks winter in the project area, mainly around Manderson.

Table 6. Waterfowl species which have been observed on the Westside Irrigation Project Area[1].

Species	Breeding Status[2]	Seasonal Status[3]
Canada Goose	*	R
Snow Goose	O	M
Mallard	*	R
Gadwall	B	R
Pintail	*	R
Green-winged Teal	B	R
Blue-winged Teal	*	S
Cinnamon Teal	B	S
American Wigeon	B	R
Northern Shoveler	B	S
Wood Duck	*	S
Redhead	B	S
Ring-necked Duck		S
Canvasback		S
Lesser Scaup	b	S
Common Goldeneye		R
Barrow's Goldeneye	b	R
Bufflehead		R
Harlequin Duck	O	S
Ruddy Duck	B	S
Hooded Merganser	O	R
Common Merganser	*	R
Sandhill Crane	*	S
Virginia Rail		S
Sora	B	S
American Coot	*	S
Common Snipe	*	S

[1]Luce 1984

Fitton and Howe 1979
Oakleaf et al. 1982

[2]*-Confirmed breeding on the Westside Project Area (nest or dependent young observed.
B-Confirmed breeding in the latilong.
b-Circumstantial evidence of breeding in the latilong.
O-Observed in the latilong.

[3]R-Yearlong Resident
S-Summer Resident
M-Migrates through Wyoming

Small Game and Furbearers

Cottontail rabbits are abundant on both upland and riparian habitat throughout the project area. Beaver, muskrat and mink are found along the river. Badger and bobcat inhabit upland areas.

Endangered Species

Black-Footed Ferret - Three white-tailed prairie dog towns of approximately 300 acres (15-20 holes/A), 300 acres (5-10 holes/A) and 1,000 acres (0-5 holes/A) respectively, occur in the project area, so potential habitat for the endangered black-footed ferret is present. Winter searches conducted on two of the towns in 1984-1985 did not indicate current use of either town by black-footed ferrets, but if searches in nearby towns on or off of the project area indicate ferret presence, the prairie dog towns on the project area could be considered part of a larger complex and have significant value.

Bald Eagle - Bald eagles winter and nest along the Bighorn River between Wind River Canyon and Yellowtail Reservoir. Nesting territories active in 1983 included one on WGFD's Yellowtail Habitat Unit adjacent to Yellowtail Reservoir and one along the Bighorn River approximately 4 miles down river from the Town of Basin. The Yellowtail nest was active in 1984. The Basin nest territory was occupied in 1984, but nesting did not take place. Nesting pairs along the Bighorn River probably winter on or near nesting territories, but defend their nest territory only during the April-July period.

The Bighorn River system is an important bald eagle wintering area. The annual January censuses conducted by BLM personnel show an average of 30 bald eagles wintering between Wind River Canyon and Basin during the years 1979-1984. An average of 14 bald eagles wintered along the Westside Project Area during those same years (Table 7).

Table 7. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming during the years 1979-1984.

Year	Wind River Canyon to Neiber	Westside Project Area	% of Total	Manderson to Basin	Total
1979	8	22	71	1	31
1980	18	15	45	0	33
1981	9	7	41	1	17
1982	0	19	100	0	19
1983	8	13	26	29	50
1984	14	9	32	5	28
Mean	10	14	47	6	30

Census work conducted by the USFWS indicates the season of use by wintering bald eagles is November-March (Jenkins 1980). Table 8 shows the results of monthly censuses along the Bighorn River between Wind River Canyon and Basin, Wyoming in 1980.

Table 8. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming during November-March 1980.

Year	Wind River Canyon to Neiber	Westside Project Area	% of Total	Manderson to Basin	Total
November	3	1	14	3	7
December	6	7	47	2	15
January	17	13	41	2	32
February	10	32	73	2	44
March	0	2	25	6	8

These data indicate that peak bald eagle numbers may not be present until February, and therefore, the January census data presented in Table 9 may not show the maximum winter populations.

Based on bald eagle distribution data, heavy winter use areas occur about 1 mile downriver from the mouth of Tenmile Creek and approximately 1 to 2 miles downriver from the Rairden Bridge where a communal roost has been reported (Jenkins 1980).

Nongame Birds and Mammals

Table 9 lists the nongame bird species which have been observed on the Westside Project Area and those which could frequent the project area based on their documented occurrence nearby. One hundred forty-nine species are found on the project area seasonally, and of these, 82 species are known to nest in habitats which may be impacted by the project. Sixty-two species listed in Table 9 have not been observed on the project area but their occurrence is probable since they are found nearby. Of these, 38 species are known to nest in the area. A few birds winter on or in the vicinity of the project area but summer and nest at higher elevations.

Table 9. Nongame bird species observed on the Westside Project Area[1].

Species	Breeding[2] Status	Seasonal[3] Status	Species	Breeding[2] Status	Seasonal[3] Status
Common Loon	O	R	Sabine's Gull	O	M
Arctic Loon		M	Forster's Tern	O	S
Horned Grebe	O	M	Common Tern	O	S
Eared Grebe	*	S	Black Tern		S
Western Grebe	B	S	Band-tailed Pigeon	O	M
Pied-billed Grebe		S	Rock Dove	B	R
White Pelican	O	S	Yellow-billed Cuckoo		S
Double-crested Cormorant	B	S	Black-billed Cuckoo	*	S
Great Blue Heron	B	S	Screech Owl	*	R
Black-Crowned Night Heron	O	S	Great Horned Owl	*	R
			Snowy Owl	O	W
Whistling Swan	O	M	Hawk Owl	O	A
Turkey Vulture	B	S	Burrowing Owl	B	S
Sharp-shinned Hawk	B	S	Long-eared Owl	O	R
Cooper's Hawk	*	S	Short-eared Owl		R
Red-tailed Hawk	*	R	Saw-whet Owl	O	R
Swainson's Hawk	B	S	Poor-will	B	S
Rough-legged Hawk		W	Common Nighthawk	*	S
Ferruginous Hawk	*	R	White-throated Swift	*	S
Golden Eagle	*	R			
Bald Eagle	*	R	Broad-tailed Hummingbird	b	S
Northern Harrier	*	S			
Osprey	O	S	Rufous Hummingbird	O	S
Gyrfalcon	O	W	Calliope Hummingbird	b	S
Prairie Falcon	*	R			
Peregrine Falcon	b	R	Belted Kingfisher	*	R
Merlin	*	R	Common Flicker	*	R
American Kestrel	*	S	Red-headed Woodpecker	*	S
American Avocet	*	S			
Semipalmated Plover	O	M	Lewis' Woodpecker	B	S
Killdeer	*	S	Yellow-bellied Sapsucker	*	S
Mountain Plover	*	S			
Black-bellied Plover	O	M	Williamson's Sapsucker	B	S
Marbled Godwit	O	M			
Long-billed Curlew	B	S	Hairy Woodpecker	*	R
Upland Sandpiper	B	S	Downy Woodpecker	*	R
Greater Yellowlegs		M	Eastern Kingbird	*	S
Lesser Yellowlegs		M	Western Kingbird	*	S
Solitary Sandpiper		M	Say's Phoebe	*	S
Willet	O	S	Willow Flycatcher	*	S
Spotted Sandpiper	*	S	Least Flycatcher	*	S
Wilson's Phalarope	B	S	Hammond's Flycatcher		S
Northern Phalarope	O	M	Dusky Flycatcher	B	S
Long-billed Dowitcher		M	Western Flycatcher	B	S
Sanderling	O	M	Western Wood Pewee	*	S
Semipalmated Sandpiper		M	Olive-sided Flycatcher	B	S
Western Sandpiper		M			
Least Sandpiper		M	Horned Lark	*	R
Baird's Sandpiper		M	Violet-green Swallow	*	S
Pectoral Sandpiper		M			

Table 9 (continued)

Species	Breeding[2] Status	Seasonal[3] Status	Species	Breeding[2] Status	Seasonal[3] Status
Stilt Sandpiper	O	M	Tree Swallow	B	S
California Gull		S	Bank Swallow	*	S
Ring-billed Gull		S	Cliff Swallow	*	S
Franklin's Gull		S	Gray Jay	b	R
Clark's Nutcracker	B	R	Blue Jay		R
Black-capped Chickadee	*	R	Blackbilled Magpie	*	R
			Common Raven	*	R
Mountain Chickadee	*	R	Common Crow	B	R
White-breasted Nuthatch	*	R	Pinon Jay	b	R
			American Redstart	B	S
Red-breasted Nuthatch	*	*	House Sparrow	*	R
			Bobolink	B	S
Brown Creeper	B	R	Western Meadowlark	B	S
Dipper	B	R	Yellow-headed Blackbird	*	S
House Wren	*	S			
Long-billed Marsh Wren	*	S	Red-winged Blackbird	*	S
				*	S
Canon Wren	*	S	Northern Oriole	*	S
Rock Wren	*	S	Rusty Blackbird	O	M
Mockingbird		S	Common Grackle	*	S
Gray Catbird	*	S	Brown-headed Cowbird	*	S
Brown Thrasher	*	S			
Sage Thrasher	*	S	Western Tanager	B	S
American Robin	*	R	Rose-breasted Grosbeak	O	M
Hermit Thrush	*	S			
Swainson's Thrush	b	S	Black-headed Grosbeak	*	S
Veery	B	S			
Eastern Bluebird	O	S	Indigo Bunting	b	S
Western Bluebird	O	S	Lazuli Bunting	*	S
Mountain Bluebird	*	S	Dickcissel	O	S
Townsend's Solitaire	B	R	Evening Grosbeck		R
Ruby-crowned Kinglet	B	S	Cassin's Finch	B	R
Water Pipit	B	S	House Finch		R
Sprague's Pipit	O	M	Pine Grosbeak	b	R
Bohemian Waxwing	O	W	Gray-crowned Rosy Finch	B	R
Cedar Waxwing	*	R			
Northern Shrike		W	Black Rosy Finch	b	R
Loggerhead Shrike	*	S	Hoary Redpoll	O	W
Starling	*	R	Common Redpoll	O	W
Solitary Vireo	B	S	Pine Siskin	B	R
Red-eyed Vireo	B	S	American Goldfinch	*	R
Philadephia Vireo	O	M	Lesser Goldfinch	O	M
Warbling Vireo	*	S	Red Crossbill	B	R
Tennessee Warbler		M	Green-tailed Towhee	b	S
Orange-crowned Warbler		S			
Nashville Warbler	O	M	White-Winged Crossbill	O	W
Yellow Warbler	*	S			
Magnolia Warbler	O	M	Rufous-sided Towhee	*	S
Yellow-rumped Warbler	*	S			
Blackburnian Warbler		M	Lark Bunting	B	S

Table 9 (continued)

Species	Breeding[2] Status	Seasonal[3] Status	Species	Breeding[2] Status	Seasonal[3] Status
Chestnut-sided Warbler	O	M	Savannah Sparrow	b	S
Ovenbird	B	S	Grasshopper Sparrow	b	S
Northern Waterthrush		M	Lark Sparrow	*	S
MacGillivray's Warbler	*	S	Sage Sparrow	*	S
Common Yellowthroat	*	S	Dark-eyed Junco	*	S
Yellow-breasted Chat	*	S	Gray-headed Junco	O	R
Wilson's Warbler	B	S	Tree Sparrow		W
Swamp Sparrow		M	Chipping Sparrow	D	S
Song Sparrow	*	R	Clay-colored Sparrow	B	S
Brewer's Sparrow	*	S	Harris' Sparrow	*	W
White crowned Sparrow	B	S	White-throated Lincoln's Sparrow	*	M S
Fox Sparrow	*	R	Snow Bunting		W
Chestnut-collared Longspur		S			

[1] Luce 1984
Fitton and Howe 1979
Oakleaf et al. 1982

[2] * - Confirmed breeding on the Westside Project Area (nest or dependent young observed)
B - Confirmed breeding in the latilong
b - Circumstantial evidence of breeding in the latilong
O - Observed in the latilong

[3] R - Yearlong resident
S - Summer resident
M - Migrates through Wyoming
A - Accidental sighting
W - Winter resident

Table 11. Estimated hunter days use/year and annual harvest on the Westside Project Area[1].

Hunter Days Location	Estimated Game Species	Use/Year	Annual Harvest
Bighorn River Segment:	Mule Deer	335**	60
	White-tailed Deer	15	2
	Canada Geese	250	50*
	Ducks		400*
	Cottontail Rabbit	100	475*
	Mourning Dove	50	290*
	Pheasant	250	240*
		1,000	
Upslope of the Bighorn Canal:	Mule Deer	160**	20
	Antelope	80**	35
	Cottontail Rabbit	20	95*
	Chukar	20	20*
		280	

[1] Thompson 1984

* Based on the average harvest/hunter day by management area (Wyoming Game and Fish Department 1984a).

**Based on the average harvest/hunter day (Wyoming Game and Fish Department 1984b).

Trapping: An estimated 50 man-days are annually spent trapping beaver, muskrat, mink, coyote, red fox and bobcat along the Bighorn River in the project area. Bobcat, coyote, badger and red fox trapping in habitats upslope of the Bighorn Canal amounts to an estimated 100 man days/year.

Since almost all of the project lands upslope of the Bighorn Canal are in the public domain, access for hunting and trapping is unlimited. Access on private land in the area for these activities is closely controlled by landowners and in many cases, public use of the wildlife resource is quite limited.

Fisheries

Boysen Reservoir

End-of-month storage records from the USGS gage on Boysen Reservoir show that the reservoir has been relatively stable since 1963. Considerable fluctuation did occur during the first 12 years after the dam was closed (1952-1962) in response to several low water years. The analyses in this report reference storage information from 1953 to the present (Table 12).

Table 12. Summary of end-of-month storage information (acre-feet) for Boysen Reservoir between 1953 and 1981.

	Mean Storage	Minimum Storage	Minimum Storage Since 1963	Maximum Storage
October	640,021	310,700	497,000	781,900
November	613,357	334,800	519,170	745,700
December	576,335	342,900	537,500	729,700
January	539,372	276,300	534,200	708,000
February	512,822	211,100	506,700	656,100
March	487,890	200,500	431,300	600,100
April	461,327	197,500	365,200	590,600
May	517,638	281,900	428,400	683,200
June	699,645	325,900	550,800	904,300
July	700,893	280,400	525,400	819,800
August	673,349	234,600	496,900	799,700
September	652,404	212,600	473,000	805,100
Mean	589,588	267,433	488,714	693,417

The minimum storage during this time period was 197,500 acre-feet which occurred in April 1956. This volume of water represents 24.6% of the reservoir's storage capacity. The minimum mean monthly storage for this 29 year period is 461,327 acre-feet which also occurs in April and represents 57.5% of the reservoir's capacity. A legally recognized minimum pool does not exist for Boysen. During times when storage contents have fallen below 350,500 acre-feet, fishery losses in the form of reduced recruitment to and growth rates of game fish have occurred. Based on this information, a minimum fisheries pool for Boysen of 350,500 acre-feet would be necessary to protect the fishery. Storage contents have fallen to or below this level 6.3 percent of the time since the reservoir first filled and have not fallen below this level since 1961.

No trout have been stocked in the reservoir since 1976 as recent management efforts have focused on improving the warm/cool water fishery in the lake. Spottail shiners have been planted in both 1982 and 1983 in an attempt to improve the forage supply (and growth rate) of walleyes. The walleye and perch fisheries have been relatively stable in recent years except when the water level has been rapidly lowered in April in anticipation of spring runoff. These reductions tend to suppress perch reproductive success by exposing gravels and weed beds upon which perch have already deposited their eggs. Additional withdrawals during the preceding summer (such as may be required for Westside) may serve to reduce the need for these drawdowns. Fish species found in Boysen Reservoir and their relative abundance are listed in Table 13. Boysen Reservoir provides approximately 27,000 fisherman days of recreational use annually in addition to other water related recreational activities according to the results of WGFD analyses in 1980.

Boysen Reservoir was classified as Resource Category 3 under the USFWS Mitigation Policy.

Table 13. List of fish species and their relative abundance in each of the four fisheries which could be affected by the Westside Project.

	Boysen	BH1	BH2	BH3
Rainbow Trout	F	A	-	-
Brown Trout	F	C	-	-
Cutthroat Trout	F	R	-	-
Brook Trout	R	R	-	-
Mountain Whitefish	F	F	-	-
Walleye	A	F	F	C
Yellow Perch	F	F	-	-
Sauger	F	C	A	A
Channel Catfish	-	F	C	C
Bluegill	F	-	-	-
Largemouth Bass	F	R	-	-
Black Crappie	F	R	-	-
Stonecat	R	F	F	F
Black Bullhead	F	-	-	-
Shovelnose Sturgeon	-	-	U	U
Burbot	C	C	F	F
Northern Redhorse	-	C	A	A
White Sucker	-	C	A	A
Longnose Sucker	-	C	C	C
Mountain Sucker	-	C	F	F
River Carpsucker	C	C	-	-
Carp	A	C	C	C
Golden Shiner	F	F	-	-
Creek Chub	F	F	-	-
Lake Chub	F	F	-	-
Flathead Chub	C	C	C	C
Sturgeon Chub	-	-	R	R
Longnose Dace	-	C	C	C
Sand Shiner	F	C	C	C
Spottail Shiner	F	R	-	-
Plains Minnow	-	F	F	F
Silvery Minnow	-	F	F	F
Fathead Minnow	-	C	C	C
Plains Killifish	F	R	-	-

A - Abundant
C - Common
F - Few
R - Rare
U - Unknown

Boysen - Boysen Reservoir
BH1 - Bighorn River from Boysen to Bighorn Canal
BH2 - Bighorn River from Bighorn Canal to Greybull River
BH3 - Bighorn River from Greybull River to Yellowtail Reservoir.

Bighorn River

Average daily releases from the reservoir are approximately 1,400 cfs. Peak flows usually occur during June and July with average releases during the

remainder of the year being fairly constant at about 1,200 cfs (Figure 4). Diversions at the Kirby Ditch, Bluff Diversion, Upper Hanover Canal and Lucerne Pump cause moderate reductions in these releases between Boysen and the Bighorn Canal.

The sport fishery in the Bighorn River between Boysen and Worland progresses from an excellent trout fishery at the reservoir and Thermopolis to a relatively poor trout fishery at Worland. This transition is largely due to increased temperature and turbidity in the river as affected by irrigation returns. Decreased flow caused by significant diversions at the upper and lower Hanover diversions and the Bighorn Canal is also a major factor contributing to this fishery change.

Since 1982, WGFD has stocked approximately 250,000 rainbow trout fingerlings between the Wedding of the Waters and Lucerne Bridge (upstream from the larger diversion structures) in an effort to increase the density of trout and angling success here. Since this stocking program was begun, a correlation has been noted between discharge and fingerling survival. Summer flows during 1982 and 1983 were abnormally high for at least parts of each summer and the survival of planted fish was relatively low. Runoff patterns (and release rates) in 1984 were more normal and fingerling survival was improved over the previous two years (Steve Yekel, WGFD personal communication).

The effect of discharge on juvenile rainbow trout is generally supported by results from the IFG-4 analysis done in 1981 (Figure 5). These data show that flows in excess of 2,000 cfs represent nearly an 80% reduction in juvenile habitat. The IFG-4 model was unable to simulate trout habitat at flows greater than 3,500 cfs; however, the observed poor survival of fingerling trout in 1982 and 1983 when flows peaked at 4,000 cfs and 7,600 cfs respectively, indicates that juvenile rainbow trout habitat probably does not increase above 3,500 cfs. In summary, prolonged flows in excess of 1,500 cfs are increasingly detrimental to rainbow trout recruitment in this portion of the Bighorn River.

This river segment has supported over 650 adult rainbow trout per mile according to results of recent studies. According to results from the HQI, the river between Boysen and the Bighorn Canal diversion supports about 40 habitat units per surface acre under an average release schedule and with a later summer flow of about 1,300 cfs (Table 14). These data indicate that at flows considerably lower than the average later summer release, HU's are significantly

Table 14. Summary of potential Habitat Quality Index habitat units at several different late summer flow rates in the Bighorn River.

Discharge (cfs)	Habitat Units Per Surface Acre
365	20.8
1,100	40.1
1,400	37.8

reduced. The impact of late summer releases greater than 1,400 cfs on adult trout HU's (standing crop) cannot be determined from these data since analyses

Nongame mammals which have been documented on the Westside Project Area and those which could frequent the project area based on their documented occurrence nearby are shown in Table 10. Twenty-one species have been observed in habitats on the project area and an additional 23 species occur nearby and may be present.

Table 10. Nongame mammal species observed on the Westside Project Area[1].

Species	Species	Species
Masked Shrew*	Least Chipmunk*	Gapper's Red-backed Vole
Dusky Shrew	Yellow-bellied Marmot	Meadow Vole
Vagrant Shrew*	Richardson's Ground Squirrel*	Montane Vole*
Dwarf Shrew	Thirteen-lined Ground Squirrel	Long-tailed Vole*
Water Shrew*	White-tailed Prairie Dog	Water Vole*
Merriam's Shrew	Dog*	Prairie Vole*
Little Brown Myotis	Northern Pocket Gopher*	Norway Rat
Small-footed Myotis	Olive-backed Pocket Mouse*	House Mouse
Long-legged Myotis	Ord's Kangaroo Rat*	Western Jumping Mouse*
Long-eared Myotis	Western Harvest Mouse*	Porcupine*
Silver-haired Bat	Deer Mouse*	Coyote*
Hoary Bat	Northern Grasshopper Mouse*	Red Fox*
Townsend's Big-eared Bat	Bushy-tailed Wood Rat	Raccoon*
Spotted Bat		Black-footed Ferret
Big Brown Bat		Spotted Skunk
White-tailed Jackrabbit*		Striped Skunk*

[1]Luce 1984
Madsen et al. 1980
Oakleaf et al. 1981
*Documented occurrence on Westside Project Area

Public Use Of Existing Resources

Hunting: Mule deer, white-tailed deer, antelope, Canada geese, ducks, cottontail rabbit, pheasant, sage grouse, chukar partridge, hungarian partridge and mourning dove are hunted on the Westside Project Area. The estimated hunter days spent per year in pursuit of each species and the estimated annual harvest are shown in Table 11.

OCT 8 1986

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, Montana

From: Regional Director, Billings, Montana

Subject: Endangered Species - Westside Project Bear Worland, Wyoming

In our letter of February 15, 1985, we asked for identification of threatene or endangered species either on the list or being proposed for the list in the project area; the proposed project lies adjacent to the Bighorn River in Washakie and Bighorn Counties.

Your response of February 27, 1985, listed the following species:

Listed Species	Expected Occurrence
Bald eagle (*Haliaeetus leucocephalus*)	Breeding and winter resident
Peregrine Falcon (*Falco peregrinus*)	Migrant and possible summer resident
Black-Footed Ferret (*Mustela nigripes*)	Possible resident on prairie dog (*Cynomys sp.*) towns

Proposed Species

None

In an April 9, 1986, memorandum we requested verification of the list. Your response of April 14, 1986, verified the preceding listed species.

Description of Proposal

The Westside plan proposes to provide irrigation service to about 4,068 acres. This would require an annual diversion requirement of about 16,680 acre-feet of water from the Bighorn River. Approximately one-third of the years would require supplemental flows from Boysen Reservoir. Water will be pumped from the existing Bighorn Canal and delivered through an 11-mile pipe system.

Affected Area

The study area includes portions of Bighorn and Washakie Counties, Wyoming (T. 49 N., R. 93-92 W., and T. 49 N., R. 92 W. - 93 W.). The lands are bordered on the east by the Bighorn canal, and on the north by Alamo Creek and Tensile Creek on the south.

The project area is mostly sagebrush and Nuttall's Saltbush. This habitat provides critical winter range for antelope and a browse area for mule deer.

Assessment Basis

Bald Eagle (Haliaeetus leucocephalus)

No historical or currently active bald eagle nests are known to occur within the project area (Denton personal communication, 1985). Therefore, it is highly unlikely that this project would interfere with the bird's reproductive capabilities.

The peak bald eagle activity in the area occurs during migratory and wintering periods. The following discussion illustrates this point (Discussion from WG&FD Report, 1986).

Bald eagles winter and nest along the Bighorn River between Wind River Canyon and Yellowtail Reservoir. Nesting territories active in 1983 included one on WGFD's Yellowtail Habitat Unit adjacent to Yellowtail Reservoir and one along the Bighorn River approximately 4 miles downriver from the town of Basin (approximately 30 miles from the project area). The Yellowtail nest was active in 1984. The Basin nest territory was occupied in 1984, but nesting did not take place. Nesting pairs along the Bighorn River probably winter on or near nesting territories, but defend their nest territory only during the April-July period.

The Bighorn River system is an important bald eagle wintering area. The annual January census conducted by BLM personnel show an average of 30 bald eagles wintering between Wind River Canyon and Basin during the years 1979-1984. An average of 14 bald eagles wintered along the Westside Project Area during those same years (Table 1).

Table 1. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming, during the years 1979-1984.

Year	Wind River Canyon to Heiber	Westside Project Area	% of Total	Manderson to Basin	Total
1979	8	22	71	1	31
1980	18	15	45	0	33
1981	9	7	41	1	17
1982	0	19	100	0	19
1983	8	13	26	29	50
1984	14	9	32	5	28
Mean	10	14	47	6	30

Census work conducted by the FWS indicates the season of use by wintering bald eagles is November-March (Jenkins 1980). Table 2 shows the results of monthly censuses along the Bighorn River between Wind River Canyon and Basin, Wyoming, in 19[illegible].

Table 2. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming, during November-March 1980.

Month	Wind River Canyon to Kolber	Worland Project Area	% of Total	Manderson to Basin	Total
November	3	1	14	3	7
December	6	7	47	2	15
January	17	13	41	2	32
February	10	32	73	2	44
March	0	2	25	6	8

These data indicate that peak bald eagle numbers may not be present until February, and therefore, the January census data presented in Table 9 may not show the maximum winter populations.

Based on bald eagle distribution data, heavy winter use areas occur about 1 mile downriver from the mouth of Tensile Creek and approximately 1 to 2 miles downriver from the Kolrden Bridge where a communal roost has been reported (Jenkins 1980).

Because the one active nest is about 30 miles from the project area, there will be no project-caused effect on the bird's nesting capabilities. The winter concentrations also occur off the project area; therefore, there will be no project-caused winter disturbances. Reduced flows on the Bighorn could impact the bird's feeding abilities.

The Bureau of Reclamation will release water from Boysen Reservoir during the critical months of July and August to meet project irrigation demands. Releases from Boysen will assure that incidences of dewatering at Worland will not increase because of project needs.

The Bureau's Reservoir Regulation Branch, Billings, will be responsible to assure that the releases are made from Boysen Reservoir so that incidences of dewatering do not occur beyond the historical levels. Wyoming Game and Fish (August 1986 meeting) has agreed that these supplemental flows would prevent a negative impact upon the fishery. Since the fishery would then be unaffected, there would be no impact upon feeding eagles. We, therefore, conclude that the project will have no impact on the bald eagle.

Peregrine Falcon (Falco peregrinus)

Peregrine falcons are known, in the area, as migrants and possible summer residents. Since there are no sites on project lands suitable for resting or nest construction, the project will not affect the peregrine falcon. (Oakleaf personal communication, 1986)

Black Footed Ferret (mustela nigripes)

Three white-tailed prairie dog towns of approximately 300 acres (15-20 holes/acre), 300 acres (5-10 holes/acre) and 1,000 acres (1-5 holes/acre) respectively, occur in the project area, so potential habitat for the endangered black-footed ferret is present. Winter searches conducted on two of the towns in 1984-1985 did not indicate current use of either town by black-footed ferrets.

Since the winter searches (Luce 1984-1985) proved negative, it is improbable that ferrets exist in the project area. The completed surveys do not, however, preclude ferret presence. Reclamation recognizes that the Westside dog towns may be a part of a larger complex and thus important to ferrets. For this reason, and in keeping with Species Endangered guidelines (1986), the Bureau of Reclamation proposes to conduct another ferret search. The ferret survey would be done within 1 year before project construction.

Conclusions

The species in question neither live on/nor depend on the project area for reproduction or as a food source; we have concluded that the Westside Project will have no effect on any threatened or endangered species.

References

Denton, Jeff 1985, Personal Communication BLM Wildlife Biologist

Oakleaf, Bob 1986. Personal Communication WG&FD Nongame Biologist.

WG&FD. 1986. Westside Irrigation Project, Combined Report on Potential Aquatic and Terrestrial Wildlife Impacts. Prepared for: Wyoming Water Development Commission and U.S. Bureau of Reclamation.. Only the amendments affecting planning documents are presented.

/s/ G. M. Wendler

bc: MB-150,-770

GLKaiser:kln retyped 9.15/86

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:
W.04 Westside Irrigation Project

April 14, 1986

To: Regional Director, Missouri Basin Region, Bureau of Reclamation, Billings, MT

From: Field Supervisor, Endangered Species, Helena, MT (SE-61130)

Subject: Westside Irrigation Project

Thank you for your April 9, 1986 memorandum requesting verification of our February 22, 1985 species list for the Westside Irrigation Project. That list included the bald eagle, peregrine falcon, and black-footed ferret; and remains current.

We appreciate your efforts to meet our joint responsibilities under the Endangered Species Act. Please contact Carol Taylor of my staff at FTS 585-5225 or the above letterhead address when we can be of further assistance, or if you have questions regarding preparation of your biological assessment.

cc: ES Cheyenne
RO (FA/SE/60153)

Surname
G 4/14 Ltr.
W 4-14-86
LL 4/14

MB-750

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, Montana

From: Regional Director, Billings, Montana

Subject: Verification of Endangered Species List - Westside Irrigation Project, Washakie and Bighorn Counties, Wyoming

We are requesting verification of your February 22, 1985, memorandum of listed, proposed, threatened or endangered species which may occur on or near the Westside Irrigation Project near Worland, Wyoming.

Our February 15, 1985, memorandum contained a project map; this map remains valid.

/s/ Robert D. Nelson

GLKaiser:kh 4-8-86

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:
6-1-85-I-018

February 22, 1985

TO: Regional Director, Bureau of Reclamation, Billings, MT.

FROM: Acting Field Supervisor, Endangered Species, Helena, MT.

SUBJECT: Westside Irrigation Project

This responds to your February 15, 1985 memorandum regarding tne proposed Westside Irrigation Project in Washakie and Big Horn Counties, Wyoming.

In accordance with Section 7(c) of the Endangered Species Act as amended ESA, we have determined that the following listed and proposed threatened and endangered species may be present in the project area.

Listed Species	Expected Occurence
Bald eagle (Haliaeetus leucocephalus)	Breeding and winter resident
Peregrine Falcon (Falco peregrinus)	Migrant and possible summer resident
Black-Footed Ferret (Mustela nigripes)	Possible resident on prairie dog (Cynomys sp.) towns

Proposed Species

None

Section 7(c) of the Act requires that you conduct and submit to the Fish and Wildlife Service (FWS) a biological assessment to determine the effects of the proposed project on listed and proposed species. If not initiated within 90 days, the list should be verified with the FWS prior to initiation of the assessment. The biological assessment should be completed within 180 days of initiation but can be extended by mutual agreement between your agency and the FWS. The assessment conducted pursuant to Section 7(c) may be undertaken as part of your agency's compliance with the requirements of Section 102 of NEPA and incorporated into the draft EIS. The biological assessment should include:

1) a description of the project;

2) the current status, habitat use, and behavior of T/E species in the project area;

3) discussion of the methods used to determine the information in item 2;

4) direct and indirect impacts of the project to T/E species;

5) cumulative impacts from federal, state, or private projects in the area;

6) mitigation/coordination measures that will reduce/ eliminate adverse impacts to T/E species;

7) the expected status of T/E species in the future (short and long term) during and after project completion;

8) determination of "no affect/may affect" to listed species.

9) citation of literature and personal contacts used in assessment.

If you determine that the project will affect any of the above listed species, formal consultation should be initiated with us.

Section 7(d) of the ESA requires that during consultation on listed species, the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives.

Pursuant to Section 7(a)(4) of the ESA, if you determine that any proposed species may be jeopardized, you should contact us to discuss conservation measures for those species.

Please contact us by mail at the above letterhead address or by telephone at 406-449-5225 (FTS 585-5225) if we can be of further assistance.

cc: Regional Director, FWS (FA/SE), Denver, CO.
Ecological Services, Billings, MT.
Ecological Services, Cheyenne, WY.

UM-750

565./123.9-

FEB 15 1985

Memorandum

To: Team Leader, Endangered Species of the Fish and Wildlife Service, Helena, Montana

From: for Regional Director, Billings, Montana

Subject: Endangered Species

We are requesting identification of listed, proposed, threatened, or endangered species which may occur on or near the Westside Irrigation Project near Worland, Wyoming.

The proposed project lies adjacent to the Bighorn River in Washakie and Big Horn Counties. For your information, a project map is enclosed.

/s/ Robert D. Mahan

Enclosure

bc: UM-770

GLKaiser:kh 2-12-85

Rare Fish

Two fish species occur in portions of the Bighorn River which, although they are not rare in other portions of their historic range, have a very limited distribution in Wyoming and are classified as rare by (WGFD 1977).

Shovelnose sturgeon once occurred in the North Platte and Powder River drainages in addition to the Bighorn River in Wyoming (Baxter and Simon 1970). The species no longer occurs in the North Platte drainage; however several specimens have been captured in the Powder River in 1983 and 1984. This species has unofficially been reported in the Bighorn and Greybull Rivers but no specimens have been captured by WGFD since closure of Bighorn Reservoir dam.

The sturgeon chub historically was found in the North Platte, Powder and Bighorn River systems in Wyoming, but today significant numbers of this species are only found in the Powder River in 1981 just upstream from Bighorn Reservoir by WGFD biologists. This species prefers riffle areas of large turbid streams and it is hypothesized that construction of dams on the North Platte River reduced turbidity enough to eliminate suitable habitat for sturgeon chubs. Populations of sturgeon chubs in the Bighorn River are apparently very low and any development activity on this river that would reduce turbidity could further reduce habitat suitability and survival of this species. Specific impacts on rare fish for either of the alternatives cannot presently be quantified.

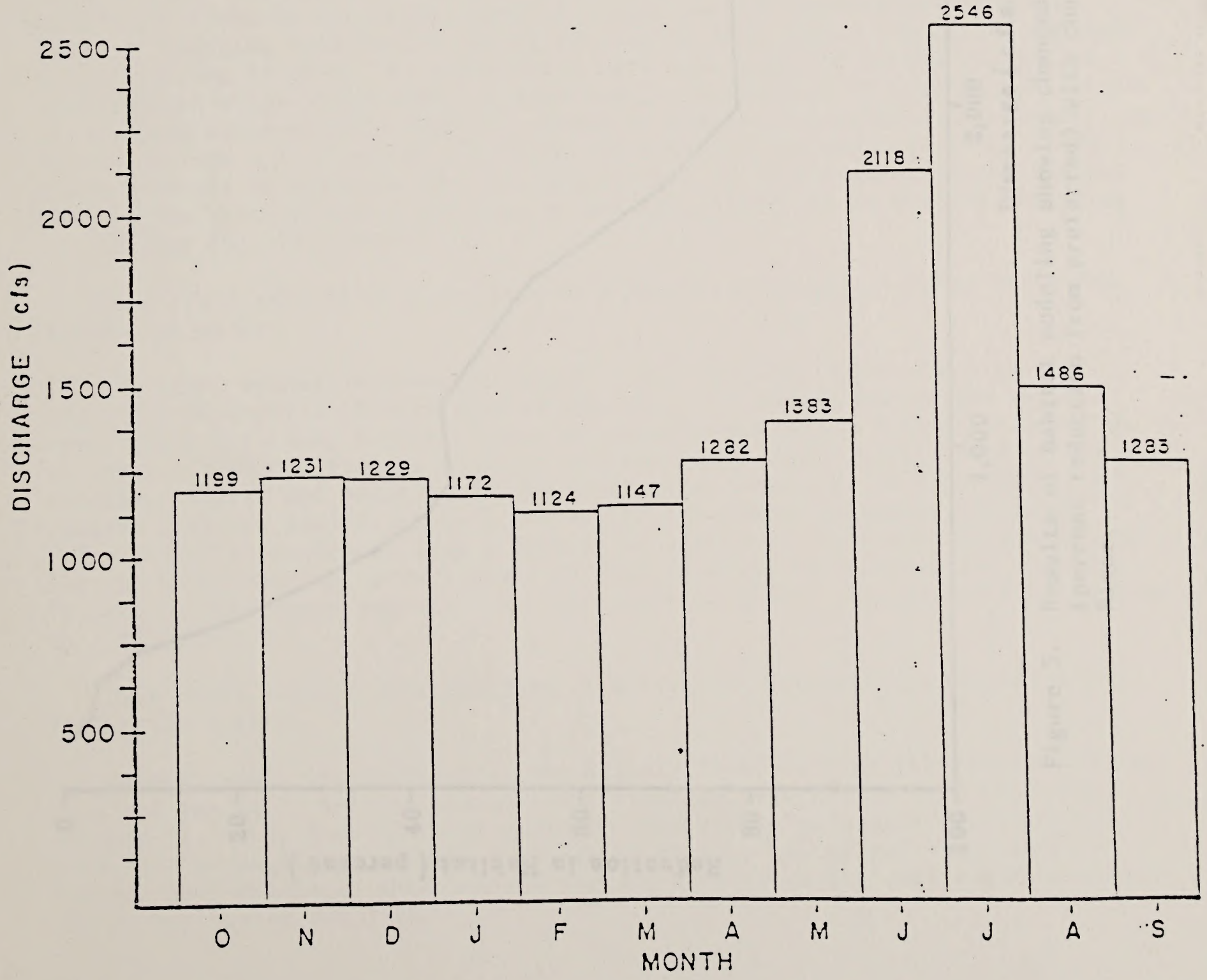
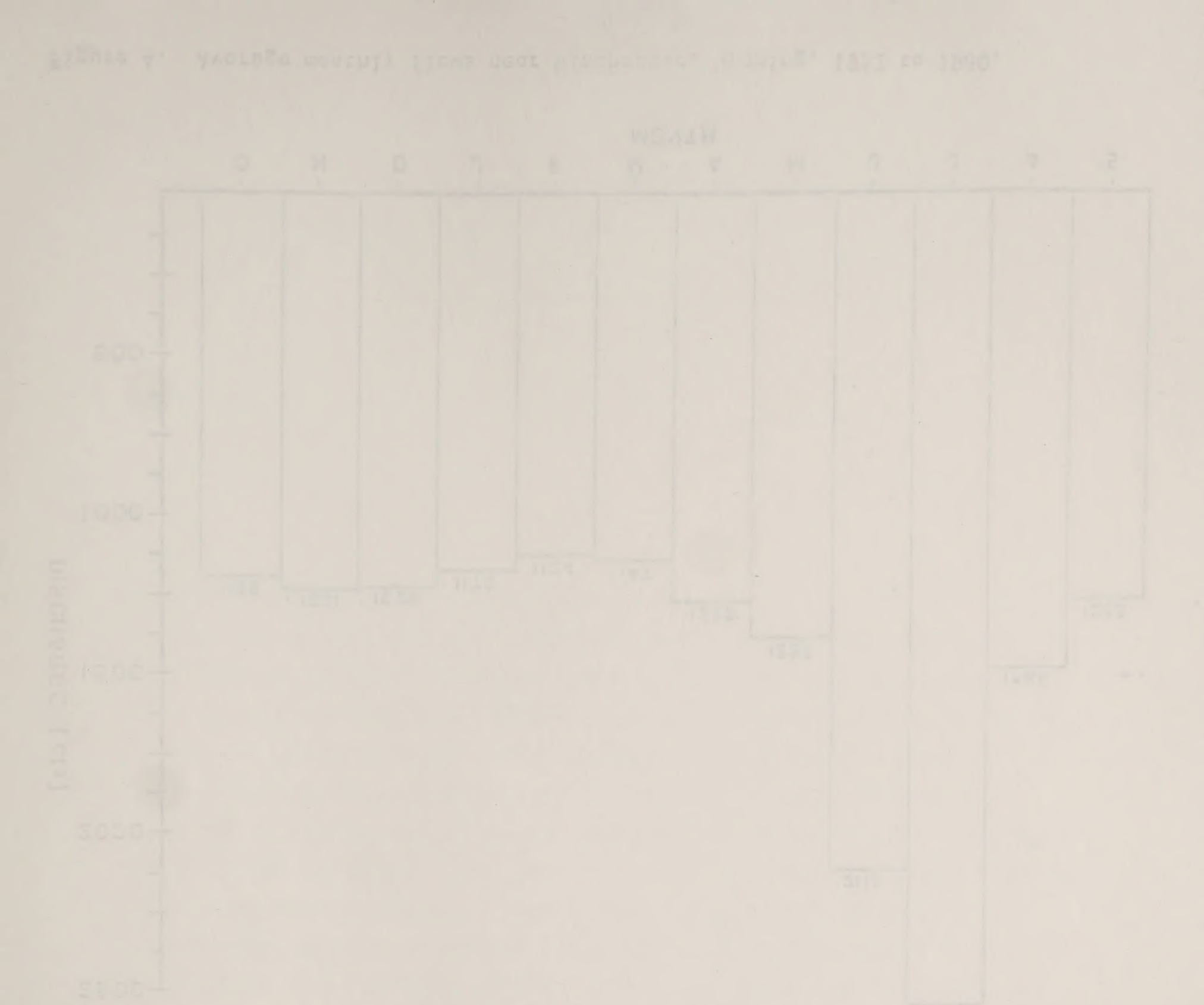


Figure 4. Average monthly flows near Winchester, Wyoming, 1952 to 1980.



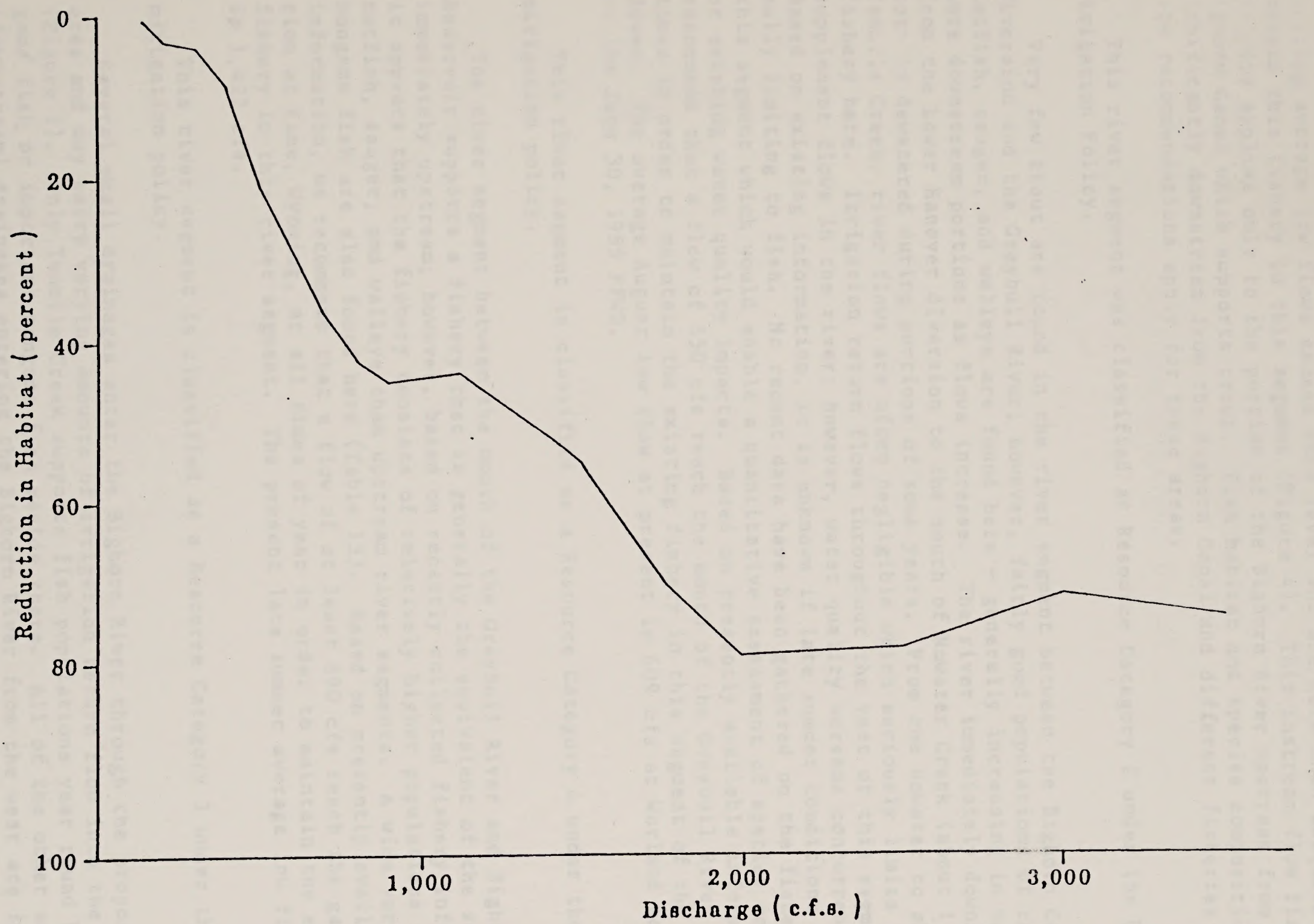


Figure 5. Results of habitat modeling showing changes in juvenile rainbow trout habitat (percent reduction from preferred) with changes in discharge in the Bighorn River.

at higher discharges were not done. The fisheries maintenance flow recommendation for the river segment between Boysen and the Bighorn Canal is 380 cfs. Existing average low flows exceed this level and are more than adequate to sustain this fishery in this segment (Figure 4). This instream flow fishery analysis applies only to the portion of the Bighorn River upstream from the Bighorn Canal which supports trout. Fish habitat and species composition change significantly downstream from the Bighorn Canal and different fisheries instream flow recommendations apply for these areas.

This river segment was classified as Resource Category 2 under the USFWS Mitigation Policy.

Very few trout are found in the river segment between the Bighorn Canal diversion and the Greybull River; however, fairly good populations of channel catfish, sauger, and walleye are found here - generally increasing in number in more downstream portions as flows increase. The river immediately downstream from the Lower Hanover diversion to the mouth of Nowater Creek (about 1 mile) is totally dewatered during portions of some years. From the Nowater to about Tenmile Creek, river flows are often negligible which seriously limits the fishery here. Irrigation return flows throughout the rest of this segment supplement flows in the river; however, water quality worsens concurrently. Based on existing information, it is unknown if late summer conditions are normally limiting to fish. No recent data have been gathered on the fishery in this segment which would enable a quantitative assessment of species composition or existing water quality impacts. Based on presently available information, we recommend that a flow of 550 cfs reach the mouth of the Greybull River at all times in order to maintain the existing fishery in this segment of the Bighorn River. The average August low flow at present is 609 cfs at Worland according to the June 30, 1985 PFWD.

This river segment is classified as a Resource Category 4 under the USFWS mitigation policy.

The river segment between the mouth of the Greybull River and Bighorn Reservoir supports a fishery that is generally the equivalent of the segment immediately upstream; however, based on recently collected fishery information, it appears that the fishery consists of relatively higher populations of channel catfish, sauger, and walleye than upstream river segments. A wide variety of nongame fish are also found here (Table 13). Based on presently available information, we recommend that a flow of at least 690 cfs reach the gaging station at Kane, Wyoming, at all times of year in order to maintain the existing fishery in this river segment. The present late summer average low flow at Kane is 1,422 cfs.

This river segment is classified as a Resource Category 3 under the USFWS mitigation policy.

Several small drainages enter the Bighorn River through the proposed project area and may carry varying amounts of irrigation return flow into the river (Figure 1). Only Tenmile Creek supports fish populations year round but no game fish or important nongame fish reside there. All of the other small (downstream) drainages entering the Bighorn River from the west are intermittent and do not harbor any fish.

SECTION 4

THREATENED/ENDANGERED SPECIES ANALYSIS

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

FEB 17 '87

Westside Irrigation Project

February 13, 1987

MEMORANDUM

To: Regional Director, Bureau of Reclamation, Missouri Basin Region, Billings, MT

From: Acting Field Supervisor, Fish and Wildlife Service, Endangered Species, Helena, MT

Subject: Westside Irrigation Project

Thank you for your January 26, 1987 letter regarding the Westside Irrigation Project. Based upon the additional information provided in your letter:

1. All powerlines constructed will be built in accordance with Raptor Research Report No. 4; and

2. Water from Boysen Reservoir will be released for Westside Project demands whenever the flow passing beyond the Bighorn Canal is equal to or less than 580 cubic feet per second;

we concur with your determination that the Westside Irrigation Project will not effect the bald eagle (Haliaeetus leucocephalus).

We appreciate your efforts to meet our joint responsibilities under the Endangered Species Act.

cc: ES, Cheyenne, WY

CTaylor:clh

"Take Pride in America"

JAN 2 6 1987

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, Montana

From: Regional Director, Billings, Montana

Subject: Westside Irrigation Project

Your letter of October 21, 1986, highlighted two needs for the bald eagle. If these needs were fulfilled your office would then concur with the Bureau's "no effect" conclusion of October 9, 1986. The following information should expedite your concurrence.

Any powerlines constructed will be built in accordance with Suggested Practices for Raptor Protection on Powerlines - The State of the Art in 1981 (Raptor Research Report No. 4). This commitment will also be a part of the Planning Report/Environmental Statement.

The flow recommendations provided by the State of Wyoming will also be adopted. There are, however, some points which need clarification. These points are: (1) the project is only responsible for those losses directly attributable to the project [table IV-A4], (2) a completed Westside Project is not responsible for flows which naturally fall below the recommended flows [table IV-A3], (3) the project cannot assume responsibility for water released past the Bighorn Canal, and (4) the project is not responsible for maintaining 690 ft^3/s at Kane; however, during a low-flow year (when flows are less than 320 ft^3/s at Worland) the flow at Kane will be above historical levels because releases will be made from Boysen Reservoir to meet Westside demands and return flows will also accrue at Kane.

Enclosures showing the flows are provided for your information.

In conclusion, to avoid an impact caused by water withdrawals, water from Boysen Reservoir will be released for Westside Project demands whenever the flow passing beyond the Bighorn Canal is equal to or less than 960 ft^3/s [this corresponds to a flow of 320 ft^3/s at Worland.] This should not be construed to mean that a flow of 550 ft^3/s would be maintained in the Bighorn River by the Westside Project.

/s/ D M Wendlen

Enclosures
GLKaiser:dlw 1-15-87 Disk 1 19.1

SECTION 5

WATER QUALITY AND QUANTITY ANALYSIS

Water Quality

The water discharged from Boysen Reservoir is of generally high quality at all times of the year. The first major chemical change in water quality downstream is effected by contributions from the hot springs at Thermopolis. The general effect of these additions is to increase hardness, conductivity and dissolved solids. At this point in the river, water quality is still acceptable from most fish.

Downstream from Thermopolis, return flow from irrigated lands, natural runoff and industrial wastewater cause gradual increases in the concentration of minerals and chemicals. The return flows also carry silt and clay particles which increase turbidity in the river and cover the river bottoms as they settle out, reducing spawning habitat for some fish species. This material returns to suspension during high water events and may irritate the fish's gills and result in increased stress, disease, and fish mortality.

During portions of the irrigation season in some years, the river is almost totally dewatered between the Lower Hanover diversion and the mouth of the Nowater Creek. Flow gradually increases beyond this point from irrigation, industrial, and municipal returns, but, water quality (temperature and chemistry) is often the poorest for fish between Worland and Manderson of any other point on the river.

Water quality in this segment is also affected by runoff from the various intermittent drainages west of the river (Figure 1). These drainages transport between 0.2 and 0.5 acre-feet of sediments per square mile annually to the river. Most of this erosion occurs during the warmer months of the year and is associated with thunderstorm activity (Agriculture 1974).

Water quality at Greybull is significantly poorer than the quality of water discharged by Boysen, but, is apparently still capable of supporting fish populations during most years based on the results of recent fishery studies.

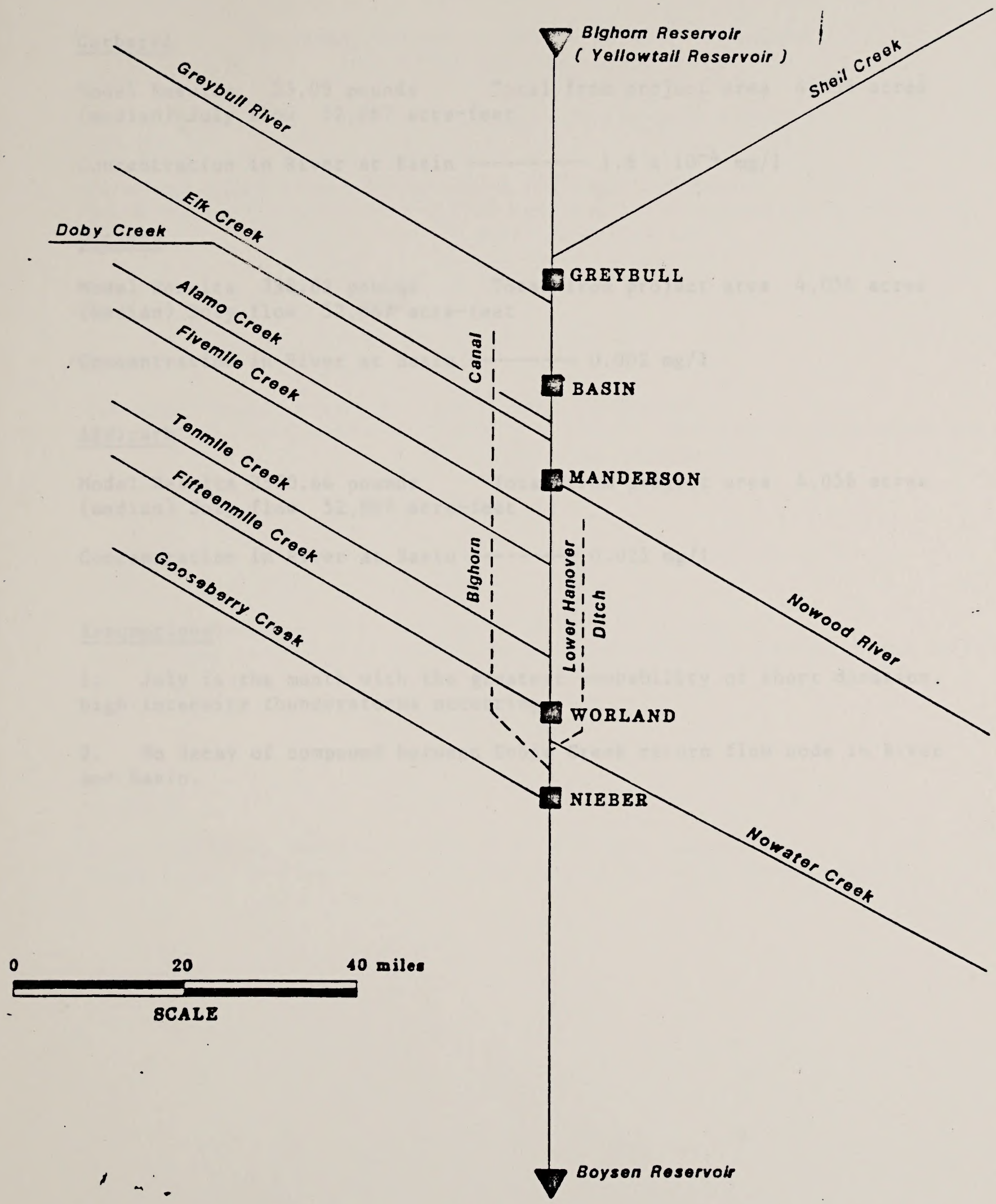


Figure 1. Location of study area.

Westside - Pesticide Runoff Model

Carbaryl

Model Results 23.09 pounds Total from project area 4,056 acres
(median) July flow 52,867 acre-feet

Concentration in River at Basin ---------- 1.6×10^{-4} mg/l

Dicamba

Model Results 338.62 pounds Total from project area 4,056 acres
(median) July flow 52,867 acre-feet

Concentration in River at Basin --------- 0.002 mg/l

Aldicarb

Model Results 3570.64 pounds Total from project area 4,056 acres
(median) July flow 52,867 acre-feet

Concentration in River at Basin --------- 0.025 mg/l

Assumptions:

1. July is the month with the greatest probability of short duration, high intensity thunderstorms occurring.

2. No decay of compound between Dobie Creek return flow node in River and Basin.

Heavy Metals
Westside Project

Resultant Concentrations at Basin with Project
from Solid Phase/Dissolved Phase

Arsenic

Dissolved Phase ---------- 1.0×10^{-3} ug/l (increase)
Solid Phase ---------- 8.55 ug/l (existing concentration and solid phase concentration)

Total 8.551 ug/l

Cadmium

Dissolved Phase ---------- 0.24 ug/l (increase)
Solid Phase ---------- 2.07×10^{-5} ug/l (existing concentration and solid phase concentration

Total 0.240 ug/l

Iron

Dissolved Phase ---------- 1.0×10^{-2} ug/l (increase)
Solid Phase ---------- 72.48 ug/l (existing concentration and solid phase concentration

Total 72.49 ug/l

Selenium

Dissolved Phase ---------- 1.04×10^{-5} ug/l (increase)
Solid Phase ---------- * (no data on existing concentration)

Water collected from two field drains in the project area showed abnormally high values of selenium. These two samples showed concentrations of 12.9 and 8.1 ppb; the standard for human health is 10 ppb. Since project lands contain selenium and existing lands show leaching of selenium, there now appears to be a high potential for the proposed project to add selenium to the Big Horn River system. The potential for leaching selenium can also be observed by the concentrations emanating from Five and Ten Mile Creeks.

This data in itself does not mean that concentrations in the Big Horn River could approach levels set for human health. This data does, however, indicate potential for further bio-accumulation of selenium in the Big Horn River. Bio-accumulation of selenium has been identified in fish tissue collected from the Yellowstone River, downstream of the Big Horn confluence.

Irrigation of project lands may add to the forementioned bio-accumulation but a determination of total project effects cannot be conceived as detrimental but only as a contributor to the present system.

Selenium Concentrations for Big Horn River Samples by Hydride Atomic Absorption Analysis

Chem Lab #	Field Sample #	Location	Se Concentration (ppb)	
F-3129	I	Above Big Horn Diversion	2.2	
F-3130	II	Five Mile	9.5	
F-3131	III	Ten Mile Creek	4.7	
F-3132	IV	Big Horn River	2.8	
F-3133	V	Drain	12.9	Existing irrigation
F-3134	3	3 Drain	8.1	

Flows Used for Water Quality Determinations

Shell Creek Near Shell, Wyoming (Water Year)
USGS Station 06278500

1952	3380	2740	2520	2390	2020	2040	5460	23020	23290	10020	5800	3490
1953	2840	2380	2300	2350	2030	2220	2100	5700	41040	8650	5470	3590
1954	2680	2520	2580	2350	1980	2070	2450	20200	16950	6360	4210	2140
1955	2170	1880	2000	1800	1740	2020	2270	17720	34370	9620	4810	2940
1956	2600	2430	2410	2270	2270	2370	2560	24250	22080	5660	3930	2650
1957	2290	2180	2090	1870	1690	1910	2000	9950	31830	9500	5750	3960
1958	560	455	394	263	194	184	149	17780	5910	2450	1330	433
1959	2760	2440	2350	2170	1760	1980	2250	7010	34020	7800	6010	4240
1960	3230	2400	2350	1960	1850	1800	2520	11190	16610	4970	4710	2860
1961	2870	2020	1980	1770	1490	1590	1720	18120	15520	4250	4160	2990
1962	3250	2900	2480	2030	1860	2000	5410	19630	34660	10600	5460	4200
1963	3380	3070	2660	2150	1950	2030	2360	16810	39870	7580	5210	3490
1964	2880	2620	2310	2180	1940	2080	2020	14560	44950	17500	70470	5250
1965	4130	2960	2880	2570	2070	2180	2600	8030	54500	15840	6940	5530
1966	4220	2860	2620	2360	1990	2220	2190	17470	9700	4510	3550	2270
1967	2370	21360	2130	1740	1560	1980	2050	13420	48180	17300	5760	5470
1968	4950	3600	2980	2550	2200	2260	2230	7150	58910	13310	8280	7990
1969	5760	4540	3710	2860	2320	2550	5440	26920	16150	12840	6220	4260
1970	3820	3000	2720	2410	2120	2190	2190	13940	41260	10860	6180	4430
1971	3060	2540	2530	2390	2040	2200	2410	17220	37970	8700	6900	4140

BIGHORN RIVER AT KANE, WYOMING (WATER YEAR)
USGS STATION 06279500

1952 94770 66820 57460 58510 47480 60810108300204800209200104300 70450 69790
1953 94910 84100 96040 99370115400130300112100102100253500 60920 50660 61240
1954 99490102400119400 96320 56800 57510 74650163500130000 87080 55120 62740
1955 81720103600110400113700 79340116900163500160000227000 81950 53550 61510
1956 76460106900151100149400147400140100 86100128200140100 54240 56310106000
1957138900143100116500 86580 87270107300 61900183500495100440200 94610104200
1958157000152000128001678001464001226007164020800015060084500 64110 95470
1959152500156400153100147600 71010 95960 92160 84370196600 98970 42020 57400
1960 92590 81840 76510 75120 69690125100 61390 61790122900 33990 41020 57660
1961 49990 43840 38580 41360 53940 53750 41430 94880106600 30800 22760 90140
1962 98400 98780 59410 50880147700179500174700162300269800130300109600102500
1963124200 98440104000 73690 97190 85290 61850114900507100171700 53620 93200
1964 92090124100127500125000 70740 84060143000243600377500191700 82270 78940
1965 86820 94140 93240105600100200126700133700143700447100543100165500128800
1966182100158800147700112600 95010 90840 55890 86090 78940 45160 39650 55010
1967 70130 75350 65240 75310 90690139100 92630146200745700716300115000115100
1968117001354001112001102001313001552001297001295003912001255001344001418 00
1969124900141200127400 96200141400166100146100147300204500154600 51960 65640
1970110700124800103400102300138500142000116400181100222700 91060 41660 65530
1971 84140 96420101600 93880123500162600146900192600439200308000 96100125800

KANE-GREYBULL-SHELL+BASIN MCI (WATER YEAR)

BASIN-1-FCOT	ABOVE MCI	INTAKE										
1952	77479.	56496.	50221.	51252.	40785.	53763.	76665.	118527.	947[illegible].	45462.	32003.	0657.
1953	85589.	77126.	89411.	92422.	110205.	123063.	104505.	73897.	1572[illegible].	12732.	22683.	6027.
1954	87929.	94576.	112301.	90272.	51245.	51613.	66135.	114457.	75486.	46602.	29983.	52677.
1955	73549.	98316.	103991.	108892.	74125.	111943.	157155.	129217.	164646.	48822.	34863.	62747.
1956	69429.	101356.	145311.	143952.	142785.	132773.	77595.	75347.	69226.	8422.	22053.	87977.
1957	126329.	136496.	110711.	82052.	82835.	102953.	54545.	132647.	273846.	343222.	44873.	84157.
1958	145659.	145271.	122547.	163429.	142271.	118689.	65566.	125777.	93986.	42912.	27183.	77544.
1959	142149.	149076.	147611.	142392.	66505.	90453.	84105.	56387.	123026.	56912.	6093.	40297.
1960	83169.	74916.	69691.	70372.	65925.	116223.	51585.	29267.	77466.	7612.	21903.	47157.
1961	40769.	35886.	32921.	36452.	49255.	48883.	35655.	55877.	42256.	-888.	-2697.	72987.
1962	86499.	88066.	52211.	44192.	140105.	171373.	154345.	113807.	164326.	70582.	72073.	84927.
1963	112119.	89256.	96021.	69912.	92435.	81133.	52405.	58467.	341906.	108122.	12753.	71827.
1964	81629.	115916.	121411.	119482.	65685.	78603.	135655.	201537.	241656.	99492.	38413.	57667.
1965	76329.	87186.	86731.	99832.	54825.	121453.	124715.	104977.	291776.	390952.	101893.	106077.
1966	169589.	149116.	139611.	104962.	88905.	84713.	47375.	47737.	42056.	9122.	9753.	36547.
1967	59299.	68486.	60291.	70552.	86625.	132873.	88025.	106707.	558596.	594192.	74883.	94047.
1968	100859.	125576.	103571.	103762.	125685.	148363.	122625.	96097.	268666.	66382.	101543.	117697.
1969	109679.	131856.	119401.	90202.	135445.	158523.	128425.	87987.	142516.	99852.	15723.	45847.
1970	100579.	117916.	97941.	97272.	133905.	137293.	108595.	140507.	109346.	39752.	4683.	45387.
1971	74829.	89216.	94981.	88422.	118755.	157473.	139925.	144477.	277206.	245562.	54963.	109767.

WESTSIDE PROJECT
ALTERNATIVE 2 — 4,056 ACRES
DETERMINING SEDIMENT LOSS AND LOADING DUE TO OVERLAND FLOW

UNIVERSAL SOIL LOSS EQUATION (USLE)

$$X(e)=E(k)(ls)C(P)$$

SEDIMENT YIELD DUE TO SURFACE EROSION

$$Y(s)=S(d)\sum_{k}[X(k)][A(k)]$$

DESCRIPTION OF VARIABLES:

E = RAINFALL/RUNOFF EROSIVITY INDEX (10 FT-TONS-IN/AC-HR)
K = SOIL ERODIBILITY (TONS/ACRE PER UNIT OF E)
ls = TOPOGRAPHIC FACTOR, DIMENSIONLESS RATIO
C = COVER/MANAGEMENT FACTOR, DIMENSIONLESS RATIO
P = SUPPORTING PRACTICE FACTOR, DIMENSIONLESS RATIO
X(e) = SOIL LOSS (TONS/ACRE)
Y(s) = ANNUAL SEDIMENT YIELD (TONS/YEAR)
X(k) = EROSION FROM SOURCE AREA k AS GIVEN BY X(e) (TONS/ACRE)
A(k) = AREA OF SOURCE AREA k (ACRE)
S(d) = WATERSHED SEDIMENT DELIVERY RATIO, DIMENSIONLESS RATIO

	VARIABLES FOR DETERMINING SEDIMENT LOSS					SEDIMENT YIELD VARIABLES		
CROP	E	K	ls	C	P	X(k)	S(d)	A(k)
ALFALFA	20	0.30	0.492	0.020	1.0	0.1	0.10	1,924
MALT BARLEY	20	0.30	0.492	0.230	1.0	0.7	0.10	962
SUGAR BEETS	20	0.30	0.492	0.330	1.0	1.0	0.10	962
PASTURE	20	0.30	0.492	0.025	1.0	0.1	0.10	208

RESULTS OF SEDIMENT LOSS AND SEDIMENT YIELD DUE TO OVERLAND FLOW

TOTAL SEDIMENT LOSS PER ALFALFA ACREAGE (TONS/YEAR) . . .	114
TOTAL SEDIMENT LOSS PER MALT BARLEY ACREAGE (TONS/YEAR) . . .	653
TOTAL SEDIMENT LOSS PER SUGAR BEET ACREAGE (TONS/YEAR) . . .	937
TOTAL SEDIMENT LOSS PER PASTURE ACREAGE (TONS/YEAR) . . .	15
TOTAL SEDIMENT LOSS FROM ALL CROP AREAS (4056 ACRES) (TONS/YEAR) . . .	1,719
TOTAL SEDIMENT YIELD DUE TO SURFACE EROSION (TONS/YEAR) . . .	172

WESTSIDE PROJECT
ALTERNATIVE 2 — 4,056 ACRES
DETERMINING SOIL LOSS DUE TO EOLIAN EFFECTS

WIND ERODIBILITY EQUATION 1/

$$X = 491.3 \left[\frac{I}{(RK)^{\frac{I}{0.835}}} \right]$$

DESCRIPTION OF VARIABLES:

X = AMOUNT OF EROSION IN TONS PER ACRE
I = SOIL ERODIBILITY INDEX BASED ON PERCENTAGE OF SURFACE MATERIAL GREATER THAN 0.84 MM IN DIAMETER (ADJUSTED FOR CLIMATIC FACTOR)
R = AMOUNT OF CROP RESIDUE IN POUNDS PER ACRE
K = RIDGE ROUGHNESS EQUIVALENT IN INCHES

	VARIABLES FOR DETERMINING SOIL LOSS				
CROP		I 2/	R	K	
MALT BARLEY		34	1883	4	
SUGAR BEETS		34	3788	4	

RESULTS OF SOIL LOSS DUE TO EOLIAN EFFECTS

SOIL LOSS PER ALFALFA ACRE (TON/ACRE/YEAR)	INSIGNIFICANT
SOIL LOSS PER MALT BARLEY ACRE (TON/ACRE/YEAR)	9.7
SOIL LOSS PER SUGAR BEET ACRE (TON/ACRE/YEAR)	5.4
SOIL LOSS PER PASTURE ACRE (TON/ACRE/YEAR).	INSIGNIFICANT

1/ CHEPIL AND WOODRUFF
2/ AVERAGE VALUES BASED ON 50% OF CROP AREA UFFENS SOIL GROUP AND REMAINING 50% RAIRDENT AND GRIFFY SOIL GROUPS. SOIL CONSERVATION SERVICE; SOIL SURVEY OF WASHAKIE COUNTY, WYOMING

WESTSIDE PROJECT
ALTERNATIVE 2 — 4,056 ACRES
SUMMARY OF SOIL LOSS DUE TO OVERLAND FLOW AND EOLIAN EFFECTS

CROP	AREA OF SOURCE (ACRE)	SOIL LOSS (WATER) (TONS/ACRE/YEAR)	SOIL LOSS (WIND) (TONS/ACRE/YEAR)	TOTAL LOSS (TONS/ACRE/YEAR)
ALFALFA	1924	0.1	INSIGNIFICANT	0.1
MALT BARLEY	962	1.0	9.7	10.7
SUGAR BEETS	962	0.7	5.4	6.1
PASTURE	208	0.1	INSIGNIFICANT	0.1

TOTAL SOIL LOSS PER ALFALFA ACREAGE (TONS/YEAR	114
TOTAL SOIL LOSS PER MALT BARLEY ACREAGE (TONS/YEAR).	9,984
TOTAL SOIL LOSS PER SUGAR BEET ACREAGE (TONS/YEAR)	6,132
TOTAL SOIL LOSS PER PASTURE ACREAGE (TONS/YEAR).	15
TOTAL SOIL LOSS PER ALL CROP AREAS (4056 ACRES)(TONS/YEAR) . .	16,245

WESTSIDE PROJECT
EXISTING CONDITION
DETERMINING SEDIMENT LOSS AND LOADING DUE TO OVERLAND FLOW

UNIVERSAL SOIL LOSS EQUATION (USLE)

$$X(e)=E(k)(ls)C(P)$$

SEDIMENT YIELD DUE TO SURFACE EROSION

$$Y(s)=S(d)\sum_{k}[X(k)][A(k)]$$

DESCRIPTION OF VARIABLES:

E = RAINFALL/RUNOFF EROSIVITY INDEX (10 FT-TONS-IN/AC-HR)
K = SOIL ERODIBILITY (TONS/ACRE PER UNIT OF E)
ls = TOPOGRAPHIC FACTOR, DIMENSIONLESS RATIO
C = COVER/MANAGEMENT FACTOR, DIMENSIONLESS RATIO
P = SUPPORTING PRACTICE FACTOR, DIMENSIONLESS RATIO
X(e) = SOIL LOSS (TONS/ACRE)
Y(s) = ANNUAL SEDIMENT YIELD (TONS/YEAR)
X(k) = EROSION FROM SOURCE AREA k AS GIVEN BY X(e) (TONS/ACRE)
A(k) = AREA OF SOURCE AREA k (ACRE)
S(d) = WATERSHED SEDIMENT DELIVERY RATIO, DIMENSIONLESS RATIO

	VARIABLES FOR DETERMINING SEDIMENT LOSS					SEDIMENT YIELD VARIABLES		
CROP	E	K	ls	C	P	X(k)	S(d)	A(k)
SAGE-GRASS	20	0.30	0.492	0.130	1.0	0.4	0.10	4056

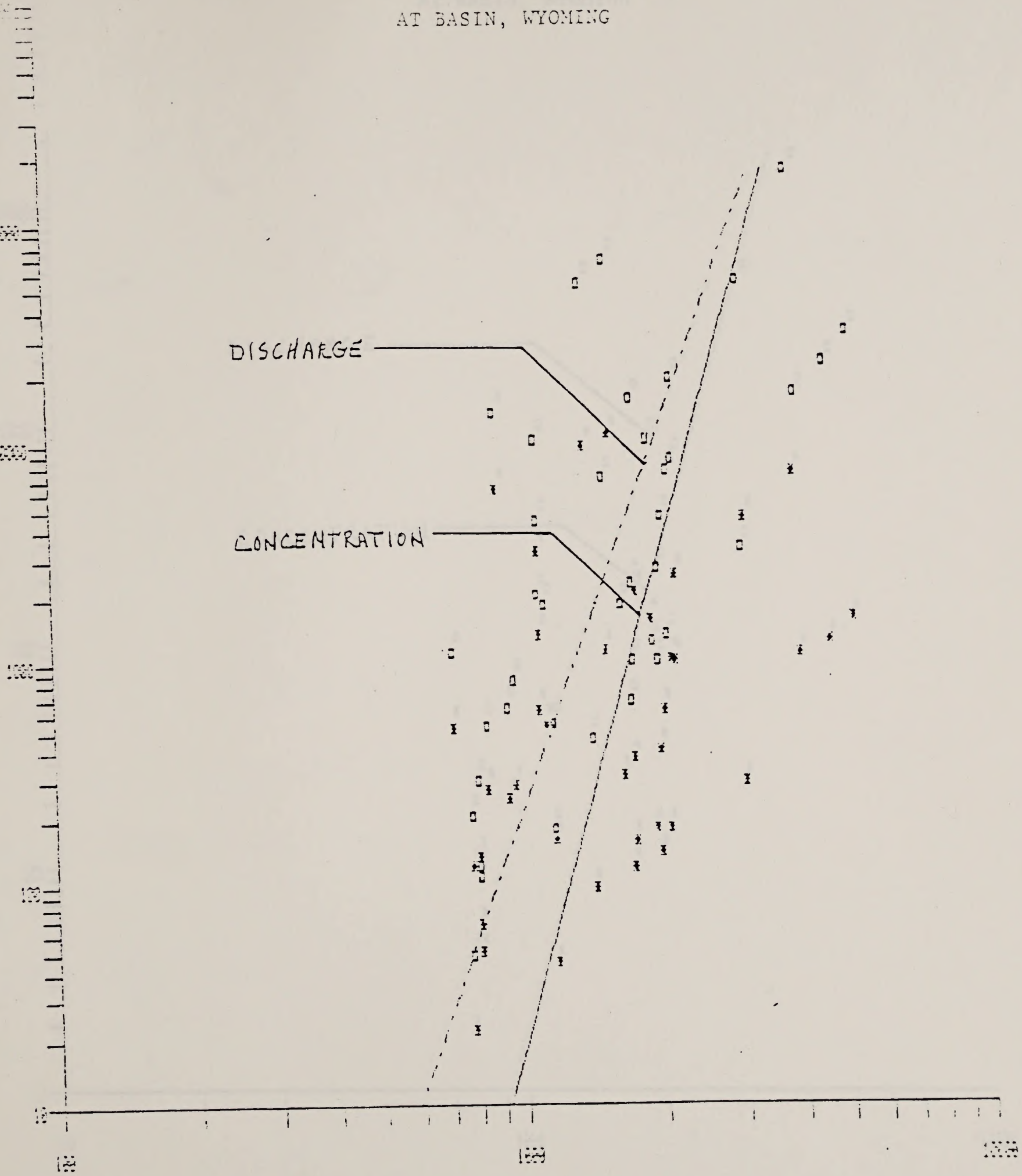
RESULTS OF SEDIMENT LOSS AND SEDIMENT YIELD DUE TO OVERLAND FLOW

TOTAL SEDIMENT LOSS FROM SAGE-GRASS AREAS (4056 ACRES) (TONS/YEAR) . . .	1,557
TOTAL SEDIMENT YIELD DUE TO SURFACE EROSION (TONS/YEAR) . . .	156

CODE	E	K	Ja	C	P	X(5)	SOD)	ADQ)
BASE-CLASS	20	0.30	0.492	0.120	1.0	0.4	0.20	4056

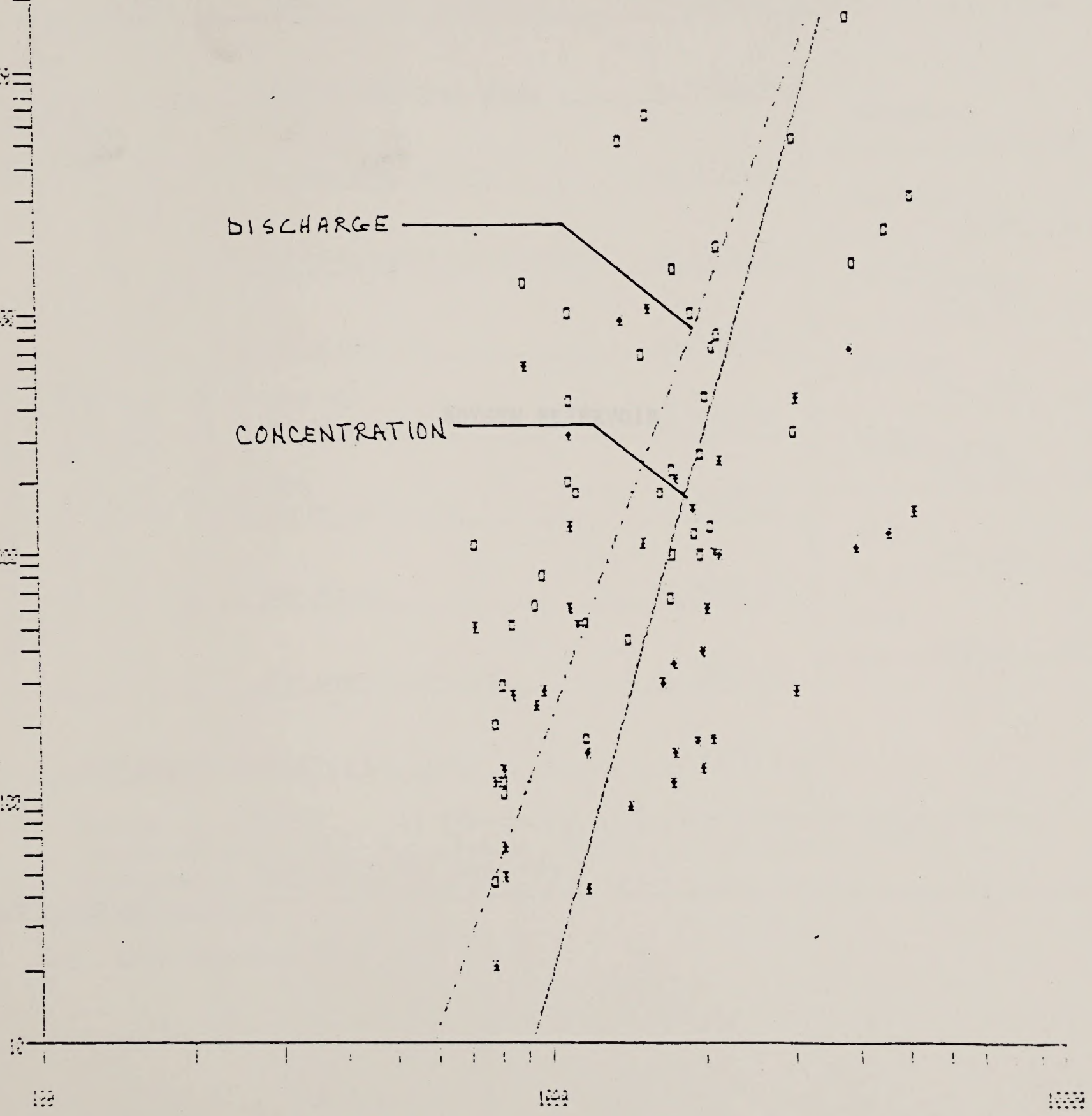
WESTSIDE PROJECT
ALTERNATIVE 2 -- 4,068 ACRES
SUSPENDED SEDIMENT TRANSPORT RELATIONSHIPS

AT BASIN, WYOMING



WESTSIDE PROJECT
EXISTING CONDITION
SUSPENDED SEDIMENT TRANSPORT RELATIONSHIP

AT BASIN, WYOMING



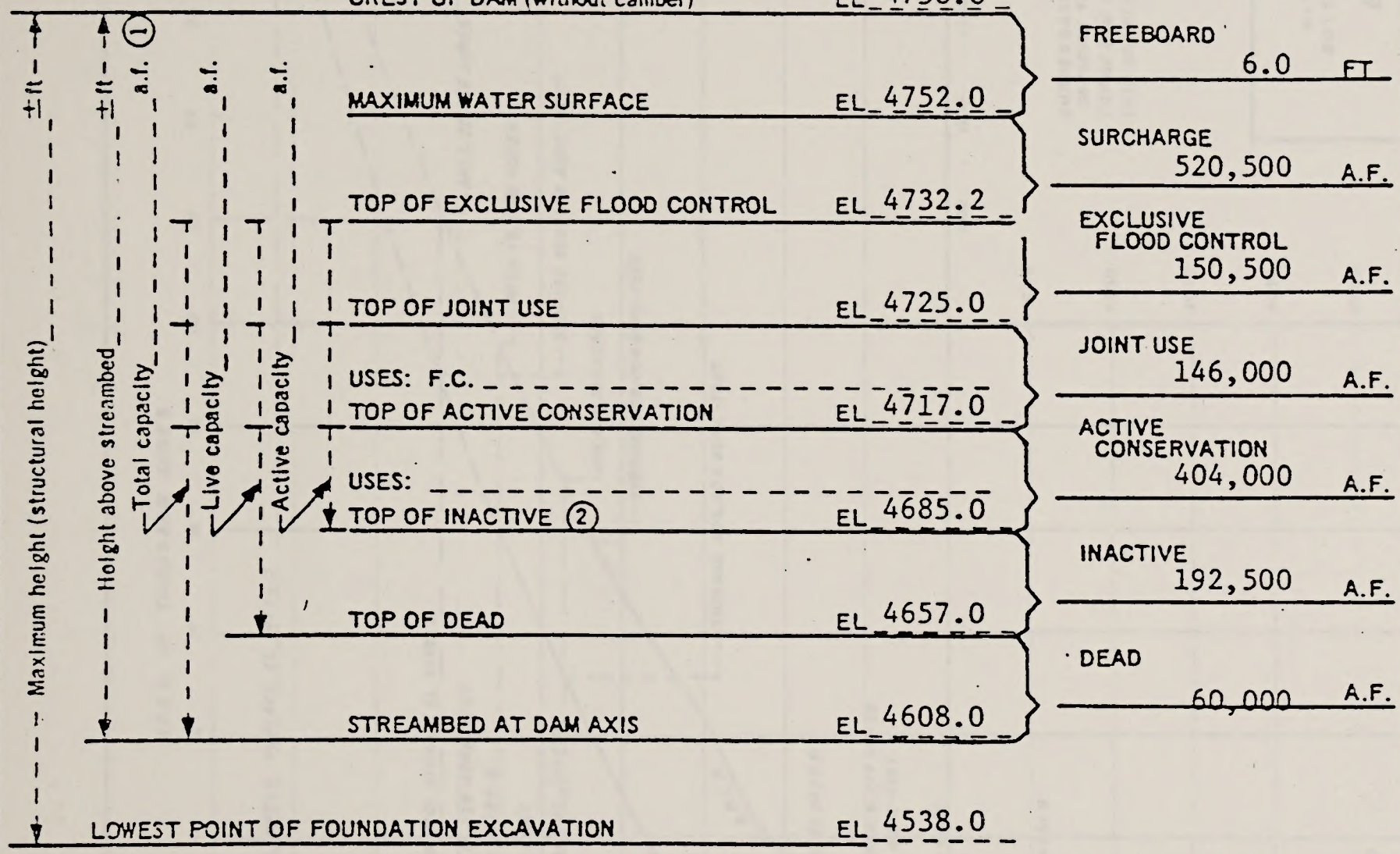
RESERVOIR CAPACITY ALLOCATIONS

BOYSEN RESERVOIR

Bolamation

RESERVOIR CAPACITY ALLOCATIONS

TYPE OF DAM	Zoned Earthfill	REGION UM	STATE Wyoming
OPERATED BY	USBR	Boysen	RESERVOIR
CREST LENGTH FT; CREST WIDTH FT		Boysen	DAM
VOLUME OF DAM 1,527,000 CU YD		Missouri River Basin	PROJECT
CONSTRUCTION PERIOD 1947-52		Boysen	DIVISION
STREAM Wind River		Boysen	UNIT
RES AREA 19,560 ACRES AT EL 4725.0		Operational	STATUS OF DAM
ORIGINATED BY:		APPROVED BY:	
(Initials)	UM-730 (Code) June '78 (Date)	(Initials)	(Code) (Date)

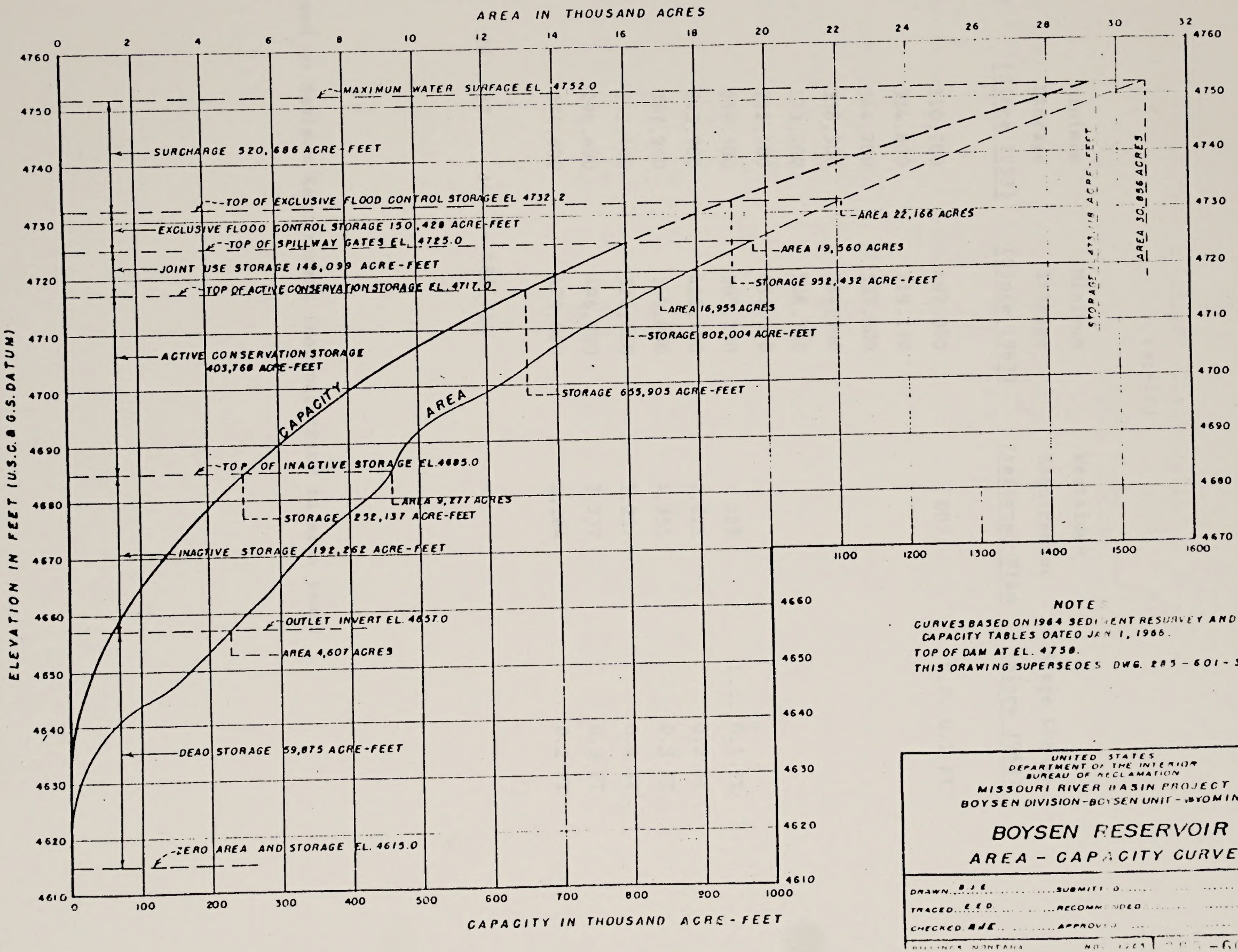


(1) Includes 140,000 a.f. allowance for 100 year sediment deposition between streambed and El 4671.1, of which 80,000 a.f. is above El 4657.0.

(2) Established by 1964 sediment resurvey

REFERENCES AND COMMENTS:

RCA dated November 1965



NOTE

CURVES BASED ON 1964 SEDIMENT RESURVEY AND AREA CAPACITY TABLES DATED JAN 1, 1966.
TOP OF DAM AT EL. 4758.
THIS DRAWING SUPERSEDES DWG. 285-601-3

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MISSOURI RIVER BASIN PROJECT
BOYSEN DIVISION-BOYSEN UNIT-WYOMING

BOYSEN RESERVOIR
AREA - CAPACITY CURVES

DRAWN B.J.E. SUBMITTED
TRACED E.E.D. RECOMMENDED
CHECKED B.J.E. APPROVED
BILLINGS, MONTANA NO. 1263 285-601-130

TABLE: MINIMUM E.O.M. STORAGE - BOYSEN RESERVOIR

COMPARISON - 1953-1991

(ac-ft)

Month	Minimum Storage (Since 1953)	Minimum Storage (Since 1963)	Westside* Requirement Preferred Plan	Stage Change (Since 1963)
Oct	310,700	497,000	607	L.T. 0.1 FT
Nov	334,800	519,170		
Dec	344,700	537,500		
Jan	338,300	534,200		
Feb	273,100	506,700		
Mar	262,500	431,300		
Apr	259,500	365,200	228	L.T. 0.1 FT
May	343,900	428,400	2,821	0.2 FT
Jun	387,900	550,800	4,355	0.3 FT
Jul	342,400	524,400	5,257	0.4 FT
Aug	296,600	496,900	3,737	0.3 FT
Sep	274,600	473,000	2,284	0.2 FT
	Ave. - 267,433	Ave. - 488,714		

* Based on Maximum Requirement (not occurring in same year)

TABLE V-A2
AVERAGE, MAXIMUM AND MINIMUM DIVERSION DATA

	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	TOTAL	AF/A
Max yr. 1970 (CIR) in.	—	3.17	7.13	8.29	6.33	3.12	0.69	28.73	
CIR x 1/12 x 4068	—	1075	2417	2810	2146	1058	234		
Farm Del. (Line 1/0.62)	—	1733	3899	4533	3461	1706	377	15709	3.86
Seepage Factor 2	—	1.203	1.095	1.071	1.080	1.108	1.356		
Diversion Requirement	—	2085	4269	4855	3738	1890	511	17348	4.26
Seepage	—	352	370	322	277	184	134	1639	
Min yr 1965 (CIR) in.	.43	1.95	4.76	7.21	4.60	1.51	0.93	21.39	
CIR x 1/12 x 4068	146	661	1614	2445	1559	512	315		
Farm Del. (Line 2/0.62)	235	1066	2603	3942	2515	826	509	11696	2.88
Seepage Factor	1.401	1.203	1.095	1.071	1.080	1.108	1.356		
Diversion Requirement	329	1283	2850	4222	2716	915	690	13005	3.20
Seepage	94	217	247	280	201	89	181	1309	
Average year (CIR) in.	0.14	2.60	5.62	7.86	5.18	3.43	0.64		
CIR x 1/12 x 4068	47	881	1905	2665	1756	1163	217		
Farm Del. (Line 2/0.62)	77	1422	3073	4298	2832	1875	350	13927	3.42
Seepage Factor	1.401	1.203	1.095	1.071	1.080	1.108	1.356		
Diversion Requirement	107	1710	3365	4603	3059	2078	475	15397	3.78
Seepage	30	288	292	305	227	203	125	1470	

GREYBULL RIVER AT MEETEETSE, WYOMING(WATER YEAR)
USGS STATION 06276500

1952	13940	7610	4750	4900	4710	5040	26220	53320	91210	48910	32730	15690
1953	6510	4620	4360	4630	3200	5050	5540	22570	55320	39630	22590	11670
1954	8910	5330	4550	3730	3610	3860	6110	28910	37640	34210	21010	7970
1955	6030	3430	4440	3040	3510	2970	4120	13130	28060	23600	13960	5870
1956	4460	2140	3410	3210	2380	4990	5990	28670	48870	40250	30410	15420
1957	10310	4450	3730	2690	2780	2470	5400	40970	189500	87570	44070	16130
1958	10810	6300	5050	4140	3970	3760	5970	64510	50780	39230	35680	17540
1959	7620	4910	3170	3070	2780	3560	5950	21040	39630	34350	30000	12910
1960	6220	4550	4500	2820	1950	7110	7330	21400	28900	21500	14490	7690
1961	6280	5960	3710	3170	3230	3310	4100	20950	48900	27530	21380	14210
1962	8680	7840	4750	4690	5770	6160	14990	28930	70890	49210	32150	13420
1963	8730	6140	5350	1660	2840	2160	7130	39690	125400	56090	35740	17930
1964	7610	5590	3810	3370	3150	3410	5370	27570	90970	74800	36900	16070
1965	6390	4020	3660	3230	3340	3100	6430	30760	100900	136400	55750	17240
1966	8320	6850	5500	5310	4150	3940	6370	20950	27260	31620	26430	16240
1967	8490	4760	2850	3050	2540	4280	2600	26140	139000	104900	34440	15630
1968	11220	6250	4680	3920	3450	4610	4890	26320	63700	45900	24660	16160
1969	9390	4830	4320	3170	3670	5060	12280	32460	45910	42000	30100	15580
1970	6330	3910	2770	2650	2510	2550	5660	26720	72170	40540	30880	15760
1971	6280	4690	4120	3100	2740	2960	4610	30970	124100	53830	34320	11940

PROGRAM RESO70

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

DATE RUN% FEB 11, 1986
PAGE 001

BR - BOYSEN RESERVOIR

BR20 - MIDNIGHT TOTAL RESERVOIR STORAGE

UNITS% AF

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	DAILY MINIMUM (AF)	DAILY MAXIMUM (AF)
1953	692013.	675593.	657412.	642223.	602758.	557046.	517421.	501472.	713143.	720638.	703056.	668588.	494872.	729087.
1954	648867.	631510.	603392.	597671.	621890.	642057.	622052.	714920.	760817.	811556.	781127.	751727.	591035.	823729.
1955	746572.	705169.	649369.	599572.	575428.	528735.	476119.	471820.	549483.	549483.	508833.	474590.	463071.	751175.
1956	478204.	444681.	404914.	341874.	273063.	262539.	259505.	419092.	754686.	810186.	785322.	718667.	251822.	814689.
1957	651544.	584766.	531845.	500608.	480014.	453124.	461852.	545417.	878107.	834238.	803003.	786276.	453589.	919374.
1958	770735.	721893.	672505.	582421.	509124.	472644.	457670.	680746.	764363.	743628.	735602.	668249.	441295.	785322.
1959	580245.	498314.	415761.	338343.	338236.	360137.	344128.	343913.	501760.	494155.	471820.	446780.	335787.	665694.
1960	456333.	450212.	438697.	419833.	400465.	399630.	406484.	381659.	387927.	342411.	296645.	274610.	273063.	456868.
1961	310684.	334828.	344664.	348663.	358157.	366342.	352685.	385127.	535112.	506086.	474590.	465103.	274804.	537190.
1962	474034.	465646.	439863.	422329.	463342.	397960.	394515.	446120.	735602.	818213.	775643.	744179.	381083.	821359.
1963	711899.	687046.	631839.	600528.	600209.	593089.	591035.	626287.	845853.	796436.	782653.	804362.	587430.	872325.
1964	781890.	728364.	642223.	565580.	554770.	544666.	498744.	500178.	716696.	802033.	748782.	705698.	466605.	821556.
1965	694284.	666205.	620757.	586490.	556439.	501183.	483672.	501904.	859819.	819779.	799708.	805138.	478759.	865551.
1966	780749.	726919.	659438.	598000.	572424.	576728.	582322.	598950.	617691.	599109.	577349.	584809.	564488.	805915.
1967	607361.	609943.	608329.	596259.	573340.	537797.	505081.	600850.	904314.	804181.	754548.	742605.	499811.	922406.
1968	745748.	711059.	670152.	636580.	587917.	550759.	494895.	488574.	764488.	774400.	796376.	764488.	471758.	799869.
1969	755297.	731937.	691085.	666547.	598634.	533352.	513951.	593884.	793465.	785313.	760165.	733960.	512091.	793853.
1970	716661.	679188.	650009.	614947.	548959.	472434.	425371.	483307.	678314.	700339.	676216.	663114.	419306.	732673.
1971	661226.	653041.	612687.	571966.	510804.	431342.	365217.	428420.	840132.	794629.	757731.	740582.	357745.	844406.
1972	744444.	705678.	695000.	631622.	601642.	561741.	503794.	576106.	798317.	781071.	738926.	697670.	501076.	739846.
1973	677790.	633275.	573034.	534241.	506655.	498688.	541500.	683209.	760352.	797152.	762412.	797152.	497143.	810317.
1974	766013.	745748.	729730.	707992.	656077.	600059.	547459.	566625.	804379.	786478.	716841.	693577.	527469.	804973.
1975	688453.	675692.	618014.	578282.	551958.	542093.	503221.	520915.	661226.	799869.	749867.	722805.	494474.	830461.
1976	708348.	690729.	646134.	571203.	511090.	477932.	408370.	444532.	606075.	688279.	738191.	738007.	380892.	739662.
1977	733408.	705145.	639733.	565709.	547459.	559457.	590559.	584964.	550759.	524410.	496862.	472975.	472975.	746497.
1978	497002.	519168.	537500.	547909.	550759.	534685.	436097.	525575.	790748.	806952.	757356.	741501.	427276.	825222.
1979	701229.	651357.	613171.	583410.	560367.	567998.	505940.	585120.	624186.	618175.	634266.	627821.	493771.	741501.
1980	634101.	625342.	605600.	582478.	565098.	546260.	523682.	689328.	827035.	770207.	712504.	667577.	521644.	840333.
1981	659853.	642428.	623855.	604650.	590717.	574408.	562809.	618659.	742789.	742421.	726058.	712865.	561283.	747059.
1982	697670.	671868.	616722.	589005.	550009.	488996.	444013.	443364.	624847.	806556.	801616.	806555.	436097.	809723.
1983	783955.	742421.	671353.	599109.	540760.	509945.	518440.	601167.	850557.	796376.	769444.	727155.	501934.	860193.
1984	702119.	652368.	632944.	613333.	593409.	581079.	551659.	618982.	720094.	798511.	775925.	755297.	537352.	802796.
1985	749118.	706924.	641586.	604017.	573950.	558257.	542834.	564946.	600059.	596100.	591350.	600059.	540760.	756046.
AVE.	666905.	638620.	599676.	561921.	534119.	508581.	482821.	537459.	714036.	721799.	695781.	675895.	460956.	782354.

END OF DATA

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

BR - BOYSEN RESERVOIR

BR30 - COMPUTED NET INFLOW

UNITS% AF

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	DAILY MINIMUM (CFS)	DAILY MAXIMUM (CFS)
1953	50031.0	37340.4	40580.2	47551.7	38215.3	38727.8	44083.4	69346.1	285536.8	74798.4	52178.9	32817.9	92.3	11846.0
1954	48406.0	49262.8	39934.4	48358.8	43593.5	42126.1	43555.0	203044.3	137250.4	146824.2	45854.9	41644.5	195.7	8506.5
1955	47630.9	41771.9	32614.4	34799.6	23778.8	28866.4	40798.8	72921.7	151565.7	64030.0	32149.1	29807.4	-180.4	4870.9
1956	47024.3	33035.7	45452.8	40528.2	29848.0	57045.0	51078.3	226661.4	409131.3	131023.1	53726.8	37260.9	110.3	12138.1
1957	47228.2	42067.0	35529.1	33029.3	35838.9	39549.4	52301.1	190377.4	520602.6	337970.4	79148.6	66882.2	119.5	15021.9
1958	98891.6	58301.5	49987.6	41651.7	44893.7	47767.5	49429.5	305697.4	152118.5	50063.0	54322.7	35344.8	223.5	11538.1
1959	45022.6	45415.1	43795.0	37427.9	36753.5	57690.2	43294.6	57652.7	226527.5	60705.5	45915.7	32501.7	256.7	6969.3
1960	59944.0	46540.1	39355.8	35552.5	28176.2	52460.6	53837.9	43057.2	74102.8	24580.0	21369.7	26459.3	121.6	2056.4
1961	57230.6	42941.1	31572.5	25857.7	29244.5	29546.0	19252.7	85867.0	211839.2	34607.6	30114.6	40998.7	142.2	6453.1
1962	61278.5	47295.8	31605.8	38536.4	92670.5	41453.1	84718.4	141855.2	379299.8	169015.0	55810.1	53412.3	126.8	11859.6
1963	57442.5	40020.7	32706.0	27402.2	39207.3	41619.3	44204.4	93046.8	439573.8	122445.0	53813.1	80618.1	64.3	17975.7
1964	54177.1	37433.6	28208.7	30911.8	31630.0	37024.6	48657.7	115655.5	325292.8	213713.9	32885.3	28320.8	72.7	9656.8
1965	40497.3	29042.8	30185.6	40083.0	34677.0	34663.9	76312.4	108245.9	537064.2	394022.5	126307.4	83370.4	129.0	13801.2
1966	97459.4	64935.4	46540.7	42749.1	34073.2	48281.2	40956.9	75965.5	83006.0	48921.3	42151.7	50146.3	74.8	3681.8
1967	57482.7	38992.4	36233.0	37182.1	41008.6	53139.3	42434.8	166910.6	623292.4	464980.7	61463.2	53443.8	202.7	19253.3
1968	73777.9	59127.2	47966.9	35333.9	47517.4	72140.4	50493.0	86821.0	348451.4	106536.3	97946.7	62605.9	122.1	9924.4
1969	81235.2	78356.4	46013.9	42652.5	37756.3	57508.5	69975.8	156713.6	290988.3	110973.2	48388.3	45319.1	170.8	9229.3
1970	56608.2	42347.1	35019.7	30349.7	30937.6	30868.0	42193.2	138346.6	264389.4	92278.2	38768.7	38317.9	204.0	6970.7
1971	44228.0	45997.1	31977.3	33063.8	34176.8	39700.9	50668.3	188058.1	634845.1	235052.3	78130.5	82984.4	117.0	15640.5
1972	92463.6	62271.6	52747.6	44309.3	79181.9	84550.4	59912.7	194117.6	449535.2	143178.8	88687.5	58578.0	244.1	12861.4
1973	75961.1	55403.3	42305.6	40138.3	32473.2	49519.9	112852.5	251820.6	172595.6	138389.7	61159.7	188868.0	116.0	9146.6
1974	105319.7	75851.9	51069.0	40363.6	36166.6	63004.1	78411.7	159726.5	419711.2	164923.5	65996.4	57140.0	42.8	11811.9
1975	64787.1	47695.1	32542.0	32236.7	30672.4	54415.1	41374.8	117666.6	271123.5	397653.0	80393.2	53451.1	-147.7	11084.1
1976	64234.1	50122.7	47170.3	34568.1	36890.2	53130.4	40739.1	137807.3	253293.9	162987.3	125539.8	71240.7	139.1	7026.0
1977	72486.5	44799.6	34947.0	24310.8	32455.1	37251.4	61308.5	57975.2	29785.8	36920.1	28391.0	24370.7	7.0	3611.4
1978	48885.6	40125.0	36782.7	33197.1	31572.7	39484.7	20659.2	166573.4	357189.2	293588.3	81596.4	57904.4	27.1	9531.6
1979	59071.7	45419.9	41216.5	32853.4	34132.5	73958.2	56942.3	186498.3	132489.6	73825.7	89989.2	55867.4	31.4	8153.6
1980	54053.9	39588.1	35067.2	32018.8	33942.5	44908.7	45633.3	242094.2	319557.2	179946.3	57355.5	49174.2	38.4	9104.6
1981	62979.3	50196.1	51586.5	41004.9	38541.4	30400.8	36272.5	109622.0	215838.6	75991.7	56656.6	53477.7	79.7	11491.0
1982	50072.3	44781.8	36668.8	32703.1	33135.1	35917.1	25682.0	66142.6	244748.7	269236.8	119979.1	118583.1	31.4	9156.9
1983	154685.9	66660.3	42842.6	40794.6	45822.1	65305.7	73501.2	190023.8	496660.9	283786.0	100434.2	71604.1	144.9	14467.0
1984	95490.8	66561.5	44761.4	45871.1	44860.1	66525.2	61855.5	216280.1	233169.6	189075.1	112500.6	88071.6	185.0	8367.3
1985	93445.6	65986.9	40750.0	42411.0	29423.4	55017.9	50262.7	91347.7	100271.5	69417.3	52893.4	58919.0	64.9	4137.5
AVE.	67258.6	49566.3	39870.8	36963.7	38583.8	48593.0	51928.9	142846.7	296692.4	162468.5	65697.5	58469.9	102.1	9919.5

PROGRAM RES071

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

DATE RUN: NOV 21, 1995
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BR - BOYSEN RESERVOIR

BR30 - COMPUTED NET INFLOW

UNITS AF

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL (AF)
1953	50031.0	37340.4	40580.2	47551.7	38215.3	38727.8	44083.4	69346.1	285536.8	74798.4	52178.9	32817.9	811207.9
1954	48406.0	49262.8	39934.4	48358.8	43593.5	42126.1	43555.0	203044.3	137250.4	146824.2	45854.9	41644.5	889854.9
1955	47630.9	41771.9	32614.4	34799.6	23778.8	28866.4	40798.8	72921.7	151565.7	64030.0	32149.1	29807.4	600734.7
1956	47024.3	33035.7	45452.8	40528.2	29848.0	57045.0	51078.3	226661.4	409131.3	131023.1	53726.8	37260.9	1161815.8
1957	47228.2	42067.0	35529.1	33029.3	35838.9	39549.4	52301.1	190377.4	520602.6	337970.4	79148.6	66882.2	1480524.2
1958	98891.6	58301.5	49987.6	41651.7	44893.7	47767.5	49429.5	305697.4	152118.5	50063.0	54322.7	35344.8	998469.5
1959	45022.6	45415.1	43795.0	37427.9	36753.5	57690.2	43294.6	57652.7	226527.5	60705.5	45915.7	32501.7	732702.0
1960	59944.0	46540.1	39355.8	35552.5	28176.2	52460.6	53837.9	43057.2	74102.8	24580.0	21369.7	26459.3	505436.1
1961	57230.6	42941.1	31572.5	25857.7	29244.5	29546.0	19252.7	85867.0	211839.2	34607.6	30114.6	40998.7	639072.2
1962	61278.5	47295.8	31605.8	38536.4	92670.5	41453.1	84718.4	141855.2	379299.8	169015.0	55810.1	53412.3	1196950.9
1963	57442.5	40020.7	32706.0	27402.2	39207.3	41619.3	44204.4	93046.8	439573.8	122445.0	53813.1	80618.1	1072099.2
1964	54177.1	37433.6	28208.7	30911.8	31630.0	37024.6	48657.7	115655.5	325292.8	213713.9	32885.3	28320.8	983911.8
1965	40497.3	29042.8	30185.6	40083.0	34677.0	34663.9	76312.4	108245.9	537064.2	394022.5	126307.4	83370.4	1534472.4
1966	97459.4	64935.4	46540.7	42749.1	34073.2	48281.2	40956.9	75965.5	83006.0	48921.3	42151.7	50146.3	675186.7
1967	57482.7	38992.4	36233.0	37182.1	41008.6	53139.3	42434.8	166910.6	623292.4	464980.7	61463.2	53443.8	1676563.6
1968	73777.9	59127.2	47966.9	35333.9	47517.4	72140.4	50493.0	86821.0	348451.4	106536.3	97946.7	62605.9	1088718.0
1969	81235.2	78356.4	46013.9	42652.5	37756.3	57508.5	69975.8	156713.6	290988.3	110973.2	48388.3	45319.1	1065881.1
1970	56608.2	42347.1	35019.7	30349.7	30937.6	30868.0	42193.2	138346.6	264389.4	92278.2	38768.7	38317.9	840424.3
1971	44228.0	45997.1	31977.3	33063.8	34176.8	39700.9	50668.3	188058.1	634845.1	235052.3	78130.5	82984.4	1498882.6
1972	92463.6	62271.6	52747.6	44309.3	79181.9	84550.4	59912.7	194117.6	449535.2	143178.8	88687.5	58578.0	1409534.2
1973	75961.1	55403.3	42305.6	40138.3	32473.2	49519.9	112852.5	251820.6	172595.6	138389.7	61159.7	188868.0	1221487.5
1974	105319.7	75851.9	51069.0	40363.6	36166.6	63004.1	78411.7	159726.5	419711.2	164923.5	65996.4	57140.0	1317684.2
1975	64787.1	47695.1	32542.0	32236.7	30672.4	54415.1	41374.8	117666.6	271123.5	397653.0	80393.2	53451.1	1224010.6
1976	64234.1	50122.7	47170.3	34568.1	36890.2	53130.4	40739.1	137807.3	253293.9	162987.3	125539.8	71240.7	1077723.9
1977	72486.5	44799.6	34947.0	24310.8	32455.1	37251.4	61308.5	57975.2	29785.8	36920.1	28391.0	24370.7	485001.7
1978	48885.6	40125.0	36782.7	33197.1	31572.7	39484.7	20659.2	166573.4	357189.2	293588.3	81596.4	57904.4	1207558.7
1979	59071.7	45419.9	41216.5	32853.4	34132.5	73958.2	56942.3	186498.3	132489.6	73825.7	89989.2	55867.4	882264.7
1980	54053.9	39588.1	35067.2	32018.8	33942.5	44908.7	45633.3	242094.2	319557.2	179946.3	53355.5	49174.2	1129339.9
1981	62979.3	50196.1	51586.5	41004.9	38541.4	30400.8	36272.5	109622.0	215838.6	75991.7	56656.6	53477.7	822568.1
1982	50072.3	44781.8	36668.8	32703.1	33135.1	35917.1	25682.0	66142.6	244748.7	269236.8	119979.1	118583.1	1077650.5
1983	154685.9	66660.3	42842.6	40794.6	45822.1	65305.7	73501.2	190023.8	496660.9	283786.0	100434.2	71604.1	1632121.4
1984	95490.8	66561.5	44761.4	45871.1	44860.1	66525.2	61855.5	216280.1	233169.6	189075.1	112500.6	88071.6	1265022.6
1985	93445.6	65986.9	40750.0	42411.0	29423.4	55017.9	50262.7	91347.7	100271.5	69417.3	52893.4	58919.0	750146.4
AVE.	67258.6	49566.3	39870.8	36963.7	38583.8	48593.0	51928.9	142846.7	296692.4	162468.5	65697.5	58469.9	1058940.1

PROGRAM RESC

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

DATE RUN% OCT 18, 1985
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BR - BOYSEN RESERVOIR

BR40 - TOTAL RESERVOIR DISCHARGE

UNITS% AF

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	DAILY MINIMUM (CFS)	DAILY MAXIMUM (CFS)
1953	67785.	53760.	58760.	62741.	77681.	84440.	83708.	85295.	73864.	67303.	69761.	67285.	640.	1822.
1954	68128.	66621.	68053.	54079.	19375.	21959.	63560.	110176.	91353.	96085.	76284.	71044.	339.	2329.
1955	52786.	83175.	88415.	84597.	47923.	75560.	93415.	77220.	73902.	64030.	72799.	64050.	345.	2225.
1956	43410.	66559.	85220.	103569.	98660.	67569.	54113.	67073.	73535.	75523.	78591.	103916.	365.	1974.
1957	114351.	108845.	88451.	64266.	56434.	66440.	43573.	106812.	187910.	381840.	110384.	83609.	541.	8018.
1958	114432.	107143.	99376.	131736.	118191.	84248.	64403.	82619.	68501.	70798.	62348.	102698.	736.	3631.
1959	133027.	127347.	126349.	114847.	36861.	35790.	59304.	57868.	68680.	68311.	68251.	57542.	450.	2217.
1960	50390.	52661.	50872.	54416.	47544.	53296.	46984.	67882.	67835.	70096.	67136.	48494.	424.	1140.
1961	21156.	18797.	21737.	21858.	19749.	21360.	32910.	53425.	61853.	63634.	61611.	50485.	293.	1104.
1962	52348.	55684.	57390.	56071.	51657.	106836.	88163.	90250.	89815.	86404.	98380.	84877.	0.	2084.
1963	89722.	64873.	87913.	58713.	39527.	48740.	46258.	57794.	220006.	171862.	67597.	58909.	278.	8518.
1964	76649.	90960.	114351.	107556.	42440.	47129.	94580.	114222.	108773.	128376.	86136.	71405.	496.	2820.
1965	51911.	57122.	75634.	74350.	64729.	89921.	93824.	90014.	179147.	434063.	146378.	77940.	790.	8059.
1966	121849.	118766.	114022.	87177.	59649.	43977.	35363.	59337.	64264.	67503.	63911.	42686.	295.	2262.
1967	34931.	36411.	37847.	49252.	63927.	88683.	75152.	71141.	319827.	565114.	111096.	65387.	402.	14204.
1968	70635.	93816.	88873.	68906.	96180.	109299.	106358.	93142.	72535.	96625.	75971.	94494.	252.	2032.
1969	90426.	101716.	86866.	67190.	105669.	122791.	89377.	76780.	91406.	119125.	73537.	71524.	245.	3195.
1970	73908.	79821.	64199.	65411.	96926.	107393.	89256.	80410.	69382.	70253.	62892.	51419.	399.	2204.
1971	46116.	54182.	72331.	73785.	95339.	119163.	116795.	124855.	223130.	280556.	115029.	100138.	750.	8146.
1972	88602.	101038.	63425.	107687.	109162.	124451.	117860.	121805.	227324.	160425.	130834.	99834.	1016.	6323.
1973	95841.	99917.	102547.	78932.	60059.	57487.	70040.	110110.	95453.	101589.	95901.	154128.	400.	4297.
1974	136459.	96117.	67087.	62102.	88082.	119022.	131012.	140561.	181956.	182824.	135634.	80404.	402.	4960.
1975	69911.	60456.	90220.	71968.	56997.	64280.	80247.	99973.	130812.	259009.	130395.	80513.	402.	5506.
1976	78692.	67741.	91765.	109499.	97004.	86289.	110301.	101645.	91749.	80783.	75628.	71429.	397.	2087.
1977	77086.	73063.	100360.	98334.	50705.	25254.	30206.	63570.	63991.	63269.	55940.	48258.	293.	1802.
1978	24859.	17958.	18450.	22788.	28723.	55559.	119248.	77095.	92015.	277384.	131193.	73759.	284.	5338.
1979	99344.	95292.	79402.	62614.	57176.	66327.	119000.	107318.	93423.	79837.	73898.	62313.	932.	2105.
1980	47774.	48347.	54809.	55140.	51322.	63747.	68212.	76447.	181850.	236775.	111058.	94102.	639.	6490.
1981	70703.	67620.	70159.	60210.	52475.	50749.	47871.	53772.	91708.	76360.	73019.	66670.	735.	2042.
1982	65268.	70584.	91815.	60420.	72131.	96930.	70665.	66791.	63265.	87527.	124919.	113643.	594.	4120.
1983	177287.	108194.	113911.	113038.	104172.	96121.	65006.	107296.	247269.	337967.	127367.	113893.	890.	7721.
1984	120528.	116313.	64185.	65482.	64784.	78855.	91275.	148957.	132057.	110658.	135086.	108700.	938.	3529.
1985	99624.	108180.	106088.	79979.	59490.	70711.	65687.	69235.	65159.	73376.	68418.	50210.	619.	2019.
AVE.	79574.	77851.	78815.	74203.	66386.	74254.	77689.	88209.	120114.	154706.	92042.	78350.	502.	4131.

PROGRAM RES071

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

DATE RUN% NOV 2 19
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BR - BOYSEN RESERVOIR

BR40 - TOTAL RESERVOIR DISCHARGE

UNITS AF

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL (AF)
1953	67785.	53760.	58760.	62741.	77681.	84440.	83708.	85295.	73864.	67303.	69761.	67285.	852383.
1954	68128.	66621.	68053.	54079.	19375.	21959.	63560.	110176.	91353.	96085.	76284.	71044.	806717.
1955	52786.	83175.	88415.	84597.	47923.	75560.	93415.	77220.	73902.	64030.	72799.	64050.	877872.
1956	43410.	66559.	85220.	103569.	98660.	67569.	54113.	67073.	73535.	75523.	78591.	103916.	917738.
1957	114351.	108845.	88451.	64266.	56434.	66440.	43573.	106812.	187910.	381840.	110384.	83609.	1412915.
1958	114432.	107143.	99376.	131736.	118191.	84248.	64403.	82619.	68501.	70798.	62348.	102698.	1106493.
1959	133027.	127347.	126349.	114847.	36861.	35790.	59304.	57868.	68680.	68311.	68251.	57542.	954177.
1960	50390.	52661.	50872.	54416.	47544.	53296.	46984.	67882.	67835.	70096.	67136.	48494.	677606.
1961	21156.	18797.	21737.	21858.	19749.	21360.	32910.	53425.	61853.	63634.	61611.	50485.	448575.
1962	52348.	55684.	57390.	56071.	51657.	106836.	88163.	90250.	89815.	86404.	98380.	84877.	917875.
1963	89722.	64873.	87913.	58713.	39527.	48740.	46258.	57794.	220006.	171862.	67597.	58909.	1011914.
1964	76649.	90960.	114351.	107556.	42440.	47129.	94580.	114222.	108773.	128376.	86136.	71405.	1082577.
1965	51911.	57122.	75634.	74350.	64729.	89921.	93824.	90014.	179147.	434063.	146378.	77940.	1435033.
1966	121849.	118766.	114022.	87177.	59649.	43977.	35363.	59337.	64264.	67503.	63911.	42686.	878504.
1967	34931.	36411.	37847.	49252.	63927.	88683.	75152.	71141.	319827.	565114.	111096.	65387.	1518768.
1968	70635.	93816.	88873.	68906.	96180.	109299.	106358.	93142.	72535.	96625.	75971.	94494.	1066834.
1969	90426.	101716.	86866.	67190.	105669.	122791.	89377.	76780.	91406.	119125.	73537.	71524.	1096407.
1970	73908.	79821.	64199.	65411.	96926.	107393.	89256.	80410.	69382.	70253.	62892.	51419.	911270.
1971	46116.	54182.	72331.	73785.	95339.	119163.	116795.	124855.	223130.	280556.	115029.	100133.	1421414.
1972	88602.	101038.	63425.	107687.	109162.	124451.	117860.	121805.	227324.	160425.	130834.	99834.	1452447.
1973	95841.	99917.	102547.	78932.	60059.	57487.	70040.	110110.	95453.	101589.	95901.	154128.	1122004.
1974	136459.	96117.	67087.	62102.	88082.	119022.	131012.	140561.	181956.	182824.	135634.	80404.	1421260.
1975	69911.	60456.	90220.	71968.	56997.	64280.	80247.	99973.	130812.	259009.	130395.	80513.	1194781.
1976	78692.	67741.	91765.	109499.	97004.	86289.	110301.	101645.	91749.	80783.	75628.	71425.	1062521.
1977	77086.	73063.	100360.	98334.	50705.	25254.	30206.	63570.	63991.	63269.	55940.	48258.	750036.
1978	24859.	17958.	18450.	22788.	28723.	55559.	119248.	77095.	92015.	277384.	131193.	73759.	939031.
1979	99344.	95292.	79402.	62614.	57176.	66327.	119000.	107318.	93423.	79837.	73898.	62313.	995944.
1980	47774.	48347.	54809.	55140.	51322.	63747.	68212.	76447.	181850.	236775.	111058.	94102.	1089583.
1981	70703.	67620.	70159.	60210.	52475.	50749.	47871.	53772.	91708.	76360.	73019.	66670.	781316.
1982	65268.	70584.	91815.	60420.	72131.	96930.	70665.	66791.	63265.	87527.	124919.	113643.	983958.
1983	177287.	108194.	113911.	113038.	104172.	96121.	65006.	107296.	247269.	337967.	127367.	113893.	1711521.
1984	120528.	116313.	64185.	65482.	64784.	78855.	91275.	148957.	132057.	110658.	135086.	108700.	1236880.
1985	99624.	108180.	106088.	79979.	59490.	70711.	65687.	69235.	65159.	73376.	68418.	50210.	916157.
AVE.	79574.	77851.	78815.	74203.	66386.	74254.	77689.	88209.	120114.	154706.	92042.	78356.	1062197.

PROGRAM RESO?0

RESERVOIR RECORDS STORAGE SYSTEM
MONTHLY RESERVOIR OPERATION RECORD

DATE RUN% OCT 18, 1985
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BR - BOYSEN RESERVOIR

BR10 - MIDNIGHT RESERVOIR ELEVATION

UNITS% FEET

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	DAILY MINIMUM (FEET)	DAILY MAXIMUM (FEET)
1953	4718.10	4717.15	4716.08	4715.17	4712.74	4709.80	4707.14	4706.04	4719.30	4719.72	4718.73	4716.74	4705.58	4720.19
1954	4715.57	4714.52	4712.78	4712.42	4713.93	4715.16	4713.94	4719.40	4721.92	4724.58	4723.00	4721.43	4712.00	4725.20
1955	4721.15	4718.85	4715.60	4712.54	4711.00	4707.91	4704.25	4703.94	4709.30	4709.30	4706.55	4704.14	4703.30	4721.40
1956	4704.40	4701.92	4698.75	4693.19	4686.42	4685.32	4685.00	4699.91	4721.59	4724.51	4723.22	4719.61	4684.18	4724.74
1957	4715.73	4711.60	4708.12	4705.98	4704.53	4702.56	4703.21	4709.03	4727.89	4725.73	4724.14	4723.27	4702.52	4729.85
1958	4722.45	4719.79	4716.97	4711.45	4706.57	4704.00	4702.90	4717.45	4722.11	4720.99	4720.55	4716.72	4701.66	4723.22
1959	4711.31	4705.82	4699.64	4692.86	4692.85	4694.87	4693.40	4693.38	4706.06	4705.53	4703.94	4702.08	4692.62	4716.57
1960	4702.80	4702.34	4701.46	4699.97	4698.38	4698.31	4698.88	4696.78	4697.32	4693.24	4688.82	4686.58	4686.42	4702.84
1961	4690.21	4692.53	4693.45	4693.82	4694.69	4695.43	4694.19	4697.08	4708.34	4706.36	4704.14	4703.45	4686.60	4708.48
1962	4704.10	4703.49	4701.55	4700.17	4703.32	4698.17	4697.88	4702.03	4720.55	4724.92	4722.71	4721.02	4696.73	4725.08
1963	4719.23	4717.82	4714.54	4712.60	4712.58	4712.13	4712.00	4714.20	4726.31	4723.80	4723.08	4724.21	4711.77	4727.61
1964	4723.04	4720.15	4715.17	4710.36	4709.65	4708.98	4705.85	4705.94	4719.50	4724.09	4721.27	4718.88	4703.56	4725.09
1965	4718.23	4716.60	4713.86	4711.71	4709.76	4706.02	4704.79	4706.07	4727.00	4725.00	4723.97	4724.25	4704.44	4727.28
1966	4722.98	4720.07	4716.20	4713.47	4711.83	4712.11	4712.47	4713.53	4714.70	4713.54	4712.15	4712.63	4711.31	4724.29
1967	4714.06	4714.22	4714.12	4713.36	4711.89	4709.53	4707.28	4713.65	4729.99	4725.11	4722.52	4721.88	4706.91	4730.83
1968	4722.05	4720.15	4717.83	4715.85	4712.83	4710.40	4706.56	4706.11	4723.05	4723.57	4724.71	4723.05	4704.89	4724.89
1969	4722.56	4721.30	4719.03	4717.62	4713.51	4709.23	4707.90	4713.21	4724.56	4724.14	4722.82	4721.41	4707.77	4724.58
1970	4720.46	4718.35	4716.65	4714.53	4710.28	4704.94	4701.36	4705.73	4718.30	4719.55	4718.18	4717.42	4700.88	4721.34
1971	4717.31	4716.83	4714.39	4711.80	4707.68	4701.83	4696.33	4701.60	4726.91	4724.62	4722.69	4721.77	4695.66	4727.12
1972	4721.98	4719.85	4719.25	4715.55	4713.70	4711.13	4707.19	4712.07	4724.81	4723.92	4721.68	4719.40	4707.00	4725.35
1973	4718.27	4715.65	4711.87	4709.29	4707.39	4706.83	4709.78	4718.58	4722.83	4724.75	4722.94	4724.75	4706.72	4725.42
1974	4723.13	4722.05	4721.18	4719.98	4717.01	4713.60	4710.18	4711.45	4725.12	4724.20	4720.47	4719.17	4708.83	4725.15
1975	4718.88	4718.15	4714.72	4712.21	4710.48	4709.82	4707.15	4708.38	4717.31	4724.89	4722.27	4720.80	4706.53	4726.43
1976	4720.00	4719.01	4716.42	4711.75	4707.70	4705.34	4700.00	4702.85	4713.98	4718.87	4721.64	4721.63	4697.70	4721.73
1977	4721.38	4719.82	4716.04	4711.39	4710.18	4710.98	4713.00	4712.64	4710.40	4708.62	4706.70	4704.98	4704.98	4722.09
1978	4706.71	4708.26	4709.51	4710.21	4710.40	4709.32	4702.20	4708.70	4724.42	4725.25	4722.67	4721.82	4701.51	4726.17
1979	4719.60	4716.73	4714.42	4712.54	4711.04	4711.54	4707.34	4712.65	4715.10	4714.73	4715.71	4715.32	4706.48	4721.82
1980	4715.70	4715.17	4713.95	4712.48	4711.35	4710.10	4708.57	4718.93	4726.26	4723.35	4720.23	4717.68	4708.43	4726.92
1981	4717.23	4716.20	4715.08	4713.89	4713.01	4711.96	4711.20	4714.76	4721.89	4721.87	4720.98	4720.25	4711.10	4722.12
1982	4719.40	4717.93	4714.64	4712.90	4710.35	4706.14	4702.81	4702.76	4715.14	4725.23	4724.98	4725.23	4702.20	4725.37
1983	4724.07	4721.87	4717.90	4713.54	4709.73	4707.62	4708.21	4713.67	4727.42	4724.71	4723.31	4721.04	4707.06	4727.89
1984	4719.65	4716.79	4715.63	4714.43	4713.18	4712.39	4710.46	4714.78	4720.65	4724.82	4723.65	4722.56	4709.50	4725.04
1985	4722.23	4719.92	4716.15	4713.85	4711.93	4710.90	4709.87	4711.34	4713.60	4713.35	4713.05	4713.60	4709.73	4722.60
AVE.	4716.79	4715.18	4712.82	4710.39	4708.54	4706.80	4704.95	4708.75	4719.50	4719.90	4718.41	4717.24	4703.23	4723.48

FLOWS USED FOR FISHERY ANALYSIS

AND

ENDANGERED SPECIES ANALYSIS

TABLE IV - A1
BIG HORN RIVER FLOWS ABOVE
BIG HORN CANAL HEADGATE (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	160.00	1312.00	1080.00	900.00	814.00	1066.00	1221.00
1953	1213.00	1527.00	1112.00	534.00	681.00	1122.00	1282.00
1954	808.00	2241.00	1581.00	1109.00	818.00	1163.00	976.00
1955	1406.00	976.00	1185.00	534.00	790.00	1046.00	771.00
1956	711.00	1669.00	1242.00	787.00	920.00	1783.00	2148.00
1957	493.00	2262.00	3767.00	6150.00	1456.00	1409.00	2247.00
1958	831.00	1885.00	973.00	599.00	573.00	1683.00	2450.00
1959	786.00	534.00	1068.00	603.00	698.00	937.00	894.00
1960	452.00	534.00	1000.00	607.00	682.00	813.00	325.00
1961	299.00	534.00	886.00	534.00	576.00	821.00	953.00
1962	1327.00	1092.00	1483.00	936.00	1209.00	1411.00	1638.00
1963	513.00	714.00	4475.00	2535.00	668.00	937.00	1416.00
1964	1485.00	2156.00	2034.00	1776.00	1034.00	1179.00	1088.00
1965	1443.00	1096.00	3478.00	7303.00	1930.00	1189.00	2332.00
1966	384.00	649.00	794.00	770.00	712.00	782.00	773.00
1967	1081.00	1104.00	6544.00	9154.00	1503.00	1423.00	1330.00
1968	1502.00	1298.00	1597.00	1038.00	1390.00	1599.00	1522.00
1969	1372.00	824.00	1406.00	1478.00	769.00	954.00	1373.00
1970	1269.00	1396.00	1080.00	771.00	606.00	851.00	854.00
1971	1777.00	2403.00	4654.00	4375.00	1635.00	1665.00	1636.00
1972	1751.00	1996.00	4810.00	2264.00	1940.00	1706.00	1772.00
1973	1006.00	2347.00	1685.00	1219.00	1491.00	2502.00	2454.00
1974	2105.00	2839.00	3561.00	2632.00	2025.00	1333.00	1268.00
1975	1141.00	1746.00	2570.00	4167.00	1911.00	1359.00	1488.00
1976	1730.00	1951.00	1599.00	846.00	1160.00	1194.00	1418.00
1977	252.00	816.00	986.00	535.00	816.00	786.00	413.00
1978	1906.00	1758.00	1547.00	4136.00	1698.00	1213.00	1343.00

NOTE: Bighorn River above headgate = Bighorn River @ Worland plus:
April=160(9/30*534);May-September=534;October=172(10/31*534)

TABLE IV - A2
BIGHORN RIVER ABOVE HEADGATE
LESS EXISTING IRRIG. ON BIGHORN CANAL (334 CFS MAX)
FOR IRRIGATION SEASON APRIL-OCTOBER

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	60.00	978.00	746.00	566.00	480.00	732.00	1113.00
1953	1113.00	1193.00	778.00	200.00	347.00	788.00	1174.00
1954	708.00	1907.00	1247.00	775.00	484.00	829.00	868.00
1955	1306.00	642.00	851.00	200.00	456.00	712.00	663.00
1956	611.00	1335.00	908.00	453.00	586.00	1449.00	2040.00
1957	393.00	1928.00	3433.00	5816.00	1122.00	1075.00	2139.00
1958	731.00	1551.00	639.00	265.00	239.00	1349.00	2342.00
1959	686.00	200.00	734.00	269.00	364.00	603.00	786.00
1960	352.00	200.00	666.00	273.00	348.00	479.00	217.00
1961	199.00	200.00	552.00	200.00	242.00	487.00	845.00
1962	1227.00	758.00	1149.00	602.00	875.00	1077.00	1530.00
1963	413.00	380.00	4141.00	2201.00	334.00	603.00	1308.00
1964	1385.00	1822.00	1700.00	1442.00	700.00	845.00	980.00
1965	1343.00	762.00	3144.00	6969.00	1596.00	855.00	2224.00
1966	284.00	315.00	460.00	436.00	378.00	448.00	665.00
1967	981.00	770.00	6210.00	8820.00	1169.00	1089.00	1222.00
1968	1402.00	964.00	1263.00	704.00	1056.00	1265.00	1414.00
1969	1272.00	490.00	1072.00	1144.00	435.00	620.00	1265.00
1970	1169.00	1062.00	746.00	437.00	272.00	517.00	746.00
1971	1677.00	2069.00	4320.00	4041.00	1301.00	1331.00	1528.00
1972	1651.00	1662.00	4476.00	1930.00	1606.00	1372.00	1664.00
1973	906.00	2013.00	1351.00	885.00	1157.00	2168.00	2346.00
1974	2005.00	2505.00	3227.00	2298.00	1691.00	999.00	1160.00
1975	1041.00	1412.00	2236.00	3833.00	1577.00	1025.00	1380.00
1976	1630.00	1617.00	1265.00	512.00	826.00	860.00	1310.00
1977	152.00	482.00	652.00	201.00	482.00	452.00	305.00
1978	1806.00	1424.00	1213.00	3802.00	1364.00	879.00	1235.00

NOTE: Existing uses on Bighorn Canal calculated as:
April:9/30*334=100;May-September=334;October:10/31*334=108

TABLE IV - A3
INSTREAM FLOW REQUIREMENT
1 FOOT BELOW BIG HORN CANAL HEADGATE (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	60.00	580.00	580.00	566.00	480.00	580.00	580.00
1953	580.00	580.00	580.00	200.00	347.00	580.00	580.00
1954	580.00	580.00	580.00	580.00	484.00	580.00	580.00
1955	580.00	580.00	580.00	200.00	456.00	580.00	580.00
1956	580.00	580.00	580.00	453.00	580.00	580.00	580.00
1957	393.00	580.00	580.00	580.00	580.00	580.00	580.00
1958	580.00	580.00	580.00	265.00	239.00	580.00	580.00
1959	580.00	200.00	580.00	269.00	364.00	580.00	580.00
1960	352.00	200.00	580.00	273.00	348.00	479.00	217.00
1961	199.00	200.00	552.00	200.00	242.00	487.00	580.00
1962	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1963	413.00	380.00	580.00	580.00	334.00	580.00	580.00
1964	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1965	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1966	284.00	315.00	460.00	436.00	378.00	448.00	580.00
1967	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1968	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1969	580.00	490.00	580.00	580.00	435.00	580.00	580.00
1970	580.00	580.00	580.00	437.00	272.00	517.00	580.00
1971	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1972	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1973	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1974	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1975	580.00	580.00	580.00	580.00	580.00	580.00	580.00
1976	580.00	580.00	580.00	512.00	580.00	580.00	580.00
1977	152.00	482.00	580.00	201.00	482.00	452.00	305.00
1978	580.00	580.00	580.00	580.00	580.00	580.00	580.00

NOTE: If value in Table IV - A2 >=580, IFR=580
If value in Table IV - A2 <580, IFR=value

TABLE IV - A4
WESTSIDE DIVERSION REQUIREMENT AT HEADGATE (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	0.00	25.66	67.64	71.61	49.24	46.16	10.47
1953	0.00	21.15	64.52	83.54	50.48	42.49	7.85
1954	4.39	30.04	58.16	84.53	55.43	45.02	8.60
1955	7.10	24.94	45.11	76.09	55.78	36.24	11.06
1956	5.27	31.36	76.00	69.96	44.17	44.52	8.45
1957	3.59	17.58	44.68	77.87	51.38	35.87	6.05
1958	1.19	45.43	52.54	56.09	55.12	42.24	10.02
1959	0.00	24.40	58.16	81.88	54.17	25.57	5.15
1960	3.84	41.71	59.78	79.05	49.71	32.71	5.75
1961	2.07	21.95	73.19	76.45	58.16	20.96	2.98
1962	0.24	14.46	59.47	65.71	45.60	40.22	10.62
1963	0.00	35.08	43.68	76.39	51.38	35.42	8.90
1964	0.00	27.92	38.94	89.79	46.02	41.36	9.64
1965	5.51	20.88	47.93	68.66	44.17	15.40	11.21
1966	2.16	45.88	56.47	80.65	48.70	38.39	9.64
1967	0.00	25.86	25.64	78.11	56.56	24.56	9.64
1968	0.88	23.94	46.80	77.51	25.71	35.36	8.81
1969	0.00	38.06	32.01	78.63	59.71	46.66	5.30
1970	0.00	33.89	71.76	78.93	60.78	31.76	8.30
1971	0.00	23.74	70.45	73.44	55.60	34.60	0.00
1972	1.04	28.85	60.90	58.39	40.78	36.94	4.94
1973	0.00	39.25	57.65	67.77	52.33	19.89	8.60
1974	10.06	26.92	76.19	73.50	46.07	34.04	5.75
1975	0.00	4.70	51.54	73.50	51.85	38.89	2.92
1976	0.00	37.14	51.86	85.49	48.22	31.94	7.62
1977	0.00	35.95	72.70	71.14	41.31	37.51	9.87
1978	0.00	2.92	63.40	66.06	45.12	27.59	9.42

TABLE IV - A5
FLOW AVAILABLE FOR WEST SIDE (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	0.00	398.00	166.00	0.00	0.00	152.00	533.00
1953	533.00	613.00	198.00	0.00	0.00	208.00	594.00
1954	128.00	1327.00	667.00	195.00	0.00	249.00	288.00
1955	726.00	62.00	271.00	0.00	0.00	132.00	83.00
1956	31.00	755.00	328.00	0.00	6.00	869.00	1460.00
1957	0.00	1348.00	2853.00	5236.00	542.00	495.00	1559.00
1958	151.00	971.00	59.00	0.00	0.00	769.00	1762.00
1959	106.00	0.00	154.00	0.00	0.00	23.00	206.00
1960	0.00	0.00	86.00	0.00	0.00	0.00	0.00
1961	0.00	0.00	0.00	0.00	0.00	0.00	265.00
1962	647.00	178.00	569.00	22.00	295.00	497.00	950.00
1963	0.00	0.00	3561.00	1621.00	0.00	23.00	728.00
1964	805.00	1242.00	1120.00	862.00	120.00	265.00	400.00
1965	763.00	182.00	2564.00	6389.00	1016.00	275.00	1644.00
1966	0.00	0.00	0.00	0.00	0.00	0.00	85.00
1967	401.00	190.00	5630.00	8240.00	589.00	509.00	642.00
1968	822.00	384.00	683.00	124.00	476.00	685.00	834.00
1969	692.00	0.00	492.00	564.00	0.00	40.00	685.00
1970	589.00	482.00	166.00	0.00	0.00	0.00	166.00
1971	1097.00	1489.00	3740.00	3461.00	721.00	751.00	948.00
1972	1071.00	1082.00	3896.00	1350.00	1026.00	792.00	1084.00
1973	326.00	1433.00	771.00	305.00	577.00	1588.00	1766.00
1974	1425.00	1925.00	2647.00	1718.00	1111.00	419.00	580.00
1975	461.00	832.00	1656.00	3253.00	997.00	445.00	800.00
1976	1050.00	1037.00	685.00	0.00	246.00	280.00	730.00
1977	0.00	0.00	72.00	0.00	0.00	0.00	0.00
1978	1226.00	844.00	633.00	3222.00	784.00	299.00	655.00

TABLE IV - A6
RELEASES REQUIRED FROM BOYSEN RESERVOIR
FOR WESTSIDE PROJECT (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	0.00	372.34	98.36	-71.61	-49.24	105.84	522.53
1953	533.00	591.85	133.48	-83.54	-50.48	165.51	586.15
1954	123.61	1296.96	608.84	110.47	-55.43	203.98	279.40
1955	718.90	37.06	225.89	-76.09	-55.78	95.76	71.94
1956	25.73	723.64	252.00	-69.96	-38.17	824.48	1451.55
1957	-3.59	1330.42	2808.32	5158.13	490.62	459.13	1552.95
1958	149.81	925.57	6.46	-56.09	-55.12	726.76	1751.98
1959	106.00	-24.40	95.84	-81.88	-54.17	-2.57	200.85
1960	-3.84	-41.71	26.22	-79.05	-49.71	-32.71	-5.75
1961	-2.07	-21.95	-73.19	-76.45	-58.16	-20.96	262.02
1962	646.76	163.54	509.53	-43.71	249.40	456.78	939.38
1963	0.00	-35.08	3517.32	1544.61	-51.38	-12.42	719.10
1964	805.00	1214.08	1081.06	772.21	73.98	223.64	390.36
1965	757.49	161.12	2516.07	6320.34	971.83	259.60	1632.79
1966	-2.16	-45.88	-56.47	-80.65	-48.70	-38.39	75.36
1967	401.00	164.14	5604.36	8161.89	532.44	484.44	632.36
1968	821.12	360.06	636.20	46.49	450.29	649.64	825.19
1969	692.00	-38.06	459.99	485.37	-59.71	-6.66	679.70
1970	589.00	448.11	94.24	-78.93	-60.78	-31.76	157.70
1971	1097.00	1465.26	3669.55	3387.56	665.40	716.40	948.00
1972	1069.96	1053.15	3835.10	1291.61	985.22	755.06	1079.06
1973	326.00	1393.75	713.35	237.23	524.67	1568.11	1757.40
1974	1414.94	1898.08	2570.81	1644.50	1064.93	384.96	574.25
1975	461.00	827.30	1604.46	3179.50	945.15	406.11	797.08
1976	1050.00	999.86	633.14	-85.49	197.78	248.06	722.38
1977	0.00	-35.95	-0.70	-71.14	-41.31	-37.51	-9.87
1978	1226.00	841.08	569.60	3155.94	738.88	271.41	645.58

The negative number is the release from Boysen Reservoir.

TABLE IV - A7
RELEASES REQUIRED FROM BOYSEN RESERVOIR
FOR WESTSIDE PROJECT (AF)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	0.00	0.00	0.00	4403.30	3027.77	0.00	0.00
1953	0.00	0.00	0.00	5136.87	3104.02	0.00	0.00
1954	0.00	0.00	0.00	0.00	3408.39	0.00	0.00
1955	0.00	0.00	0.00	4678.77	3429.91	0.00	0.00
1956	0.00	0.00	0.00	4301.84	2347.07	0.00	0.00
1957	213.61	0.00	0.00	0.00	0.00	0.00	0.00
1958	0.00	0.00	0.00	3448.97	3389.33	0.00	0.00
1959	0.00	1500.36	0.00	5034.80	3330.91	152.91	0.00
1960	228.48	2564.75	0.00	4860.78	3056.67	1946.25	353.57
1961	123.17	1349.71	4354.80	4700.91	3576.26	1247.12	0.00
1962	0.00	0.00	0.00	2687.73	0.00	0.00	0.00
1963	0.00	2157.07	0.00	0.00	3159.36	738.99	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1966	128.52	2821.16	3359.96	4959.17	2994.56	2284.20	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	2340.31	0.00	0.00	3671.57	396.27	0.00
1970	0.00	0.00	0.00	4853.41	3737.36	1889.72	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	5256.78	0.00	0.00	0.00
1977	0.00	2210.57	41.65	4374.40	2540.15	2231.84	606.91
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00

53
26
1
27

TABLE IV - A8
INSTREAM FLOWS
DIRECTLY BELOW BIGHORN CANAL (CFS)

YEAR	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCTOBER
1952	60.00	952.34	678.36	566.00	480.00	685.84	1102.53
1953	1113.00	1171.85	713.48	200.00	347.00	745.51	1166.15
1954	703.61	1876.96	1188.84	690.47	484.00	783.98	859.40
1955	1298.90	617.06	805.89	200.00	456.00	675.76	651.94
1956	605.73	1303.64	832.00	453.00	580.00	1404.48	2031.55
1957	393.00	1910.42	3388.32	5738.13	1070.62	1039.13	2132.95
1958	729.81	1505.57	586.46	265.00	239.00	1306.76	2331.98
1959	686.00	200.00	675.84	269.00	364.00	580.00	780.85
1960	352.00	200.00	606.22	273.00	348.00	479.00	217.00
1961	199.00	200.00	552.00	200.00	242.00	487.00	842.02
1962	1226.76	743.54	1089.53	580.00	829.40	1036.78	1519.38
1963	413.00	380.00	4097.32	2124.61	334.00	580.00	1299.10
1964	1385.00	1794.08	1661.06	1352.21	653.98	803.64	970.36
1965	1337.49	741.12	3096.07	6900.34	1551.83	839.60	2212.79
1966	284.00	315.00	460.00	436.00	378.00	448.00	655.36
1967	981.00	744.14	6184.36	8741.89	1112.44	1064.44	1212.36
1968	1401.12	940.06	1216.20	626.49	1030.29	1229.64	1405.19
1969	1272.00	490.00	1039.99	1065.37	435.00	580.00	1259.70
1970	1169.00	1028.11	674.24	437.00	272.00	517.00	737.70
1971	1677.00	2045.26	4249.55	3967.56	1245.40	1296.40	1528.00
1972	1649.96	1633.15	4415.10	1871.61	1565.22	1335.06	1659.06
1973	906.00	1973.75	1293.35	817.23	1104.67	2148.11	2337.40
1974	1994.94	2478.08	3150.81	2224.50	1644.93	964.96	1154.25
1975	1041.00	1407.30	2184.46	3759.50	1525.15	986.11	1377.08
1976	1630.00	1579.86	1213.14	512.00	777.78	828.06	1302.38
1977	152.00	482.00	580.00	201.00	482.00	452.00	305.00
1978	1806.00	1421.08	1149.60	3735.94	1318.88	851.41	1225.58

Flows in Big Horn River after Westside is developed. Compare this table with Table IV-A2. The flows with the project (Table IV-A8) are always equal to or greater than flows without the project (Table IV-A3).

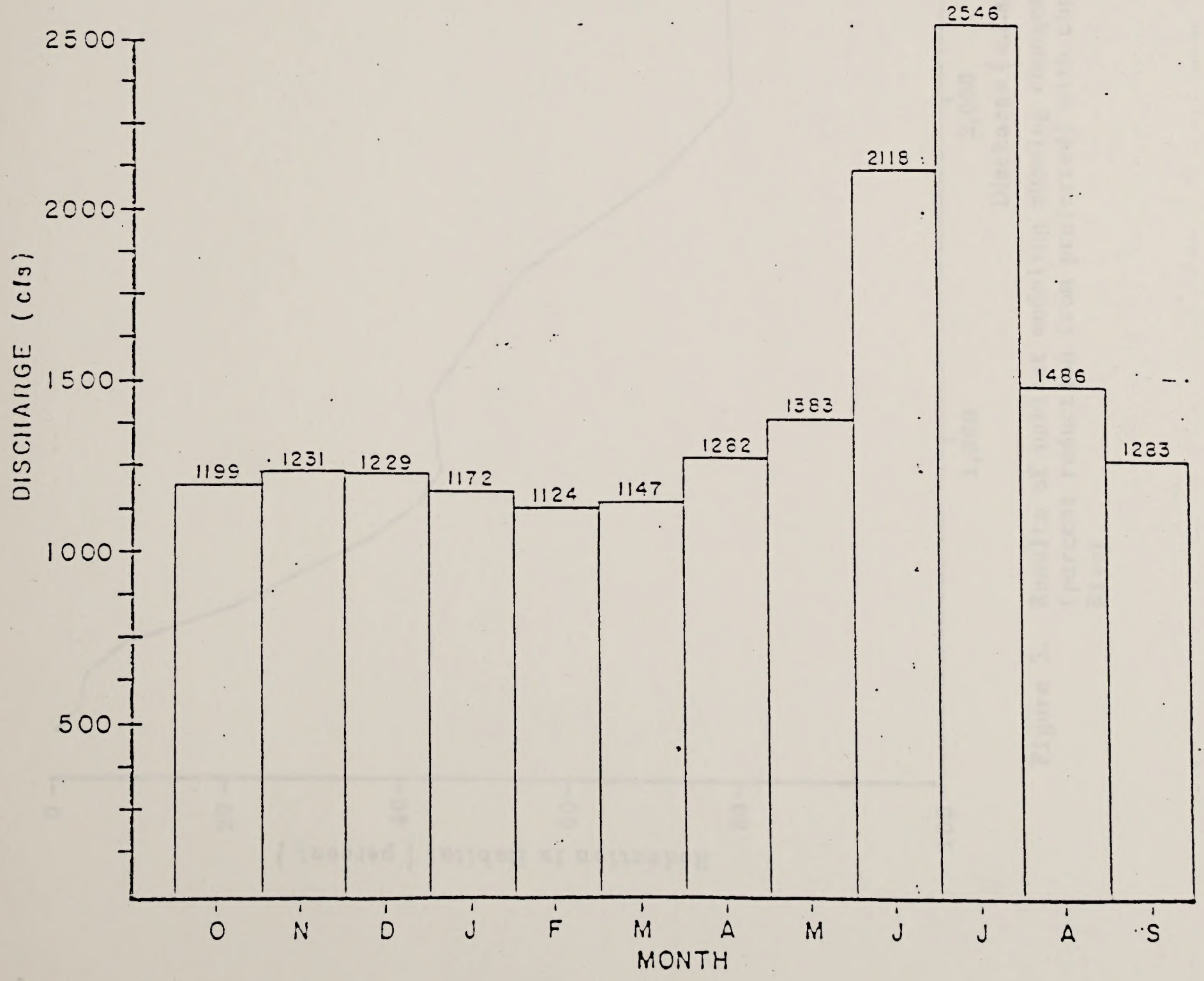


Figure 4. Average monthly flows near Winchester, Wyoming, 1952 to 1980.

Figure 5. Results of habitat modeling showing changes in juvenile rainbow trout habitat (percent reduction from preferred) with changes in discharge in the Bighorn River.

ANNEX. 6

VEGETATION MAPS

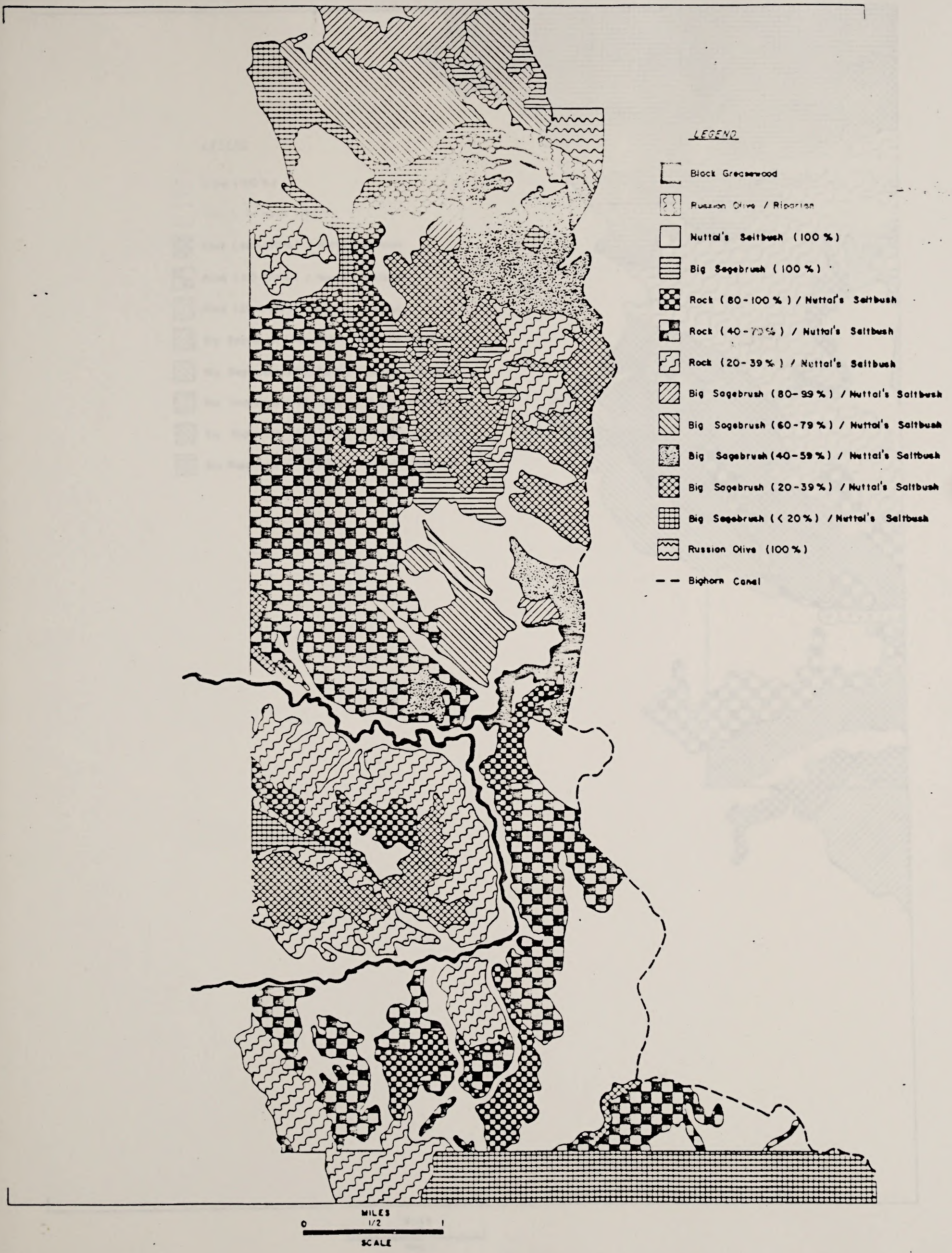


Figure 5a. Westside Irrigation Project With Vegetation Plotted.

ORCHARD BENCH, WYO.
Vegetation

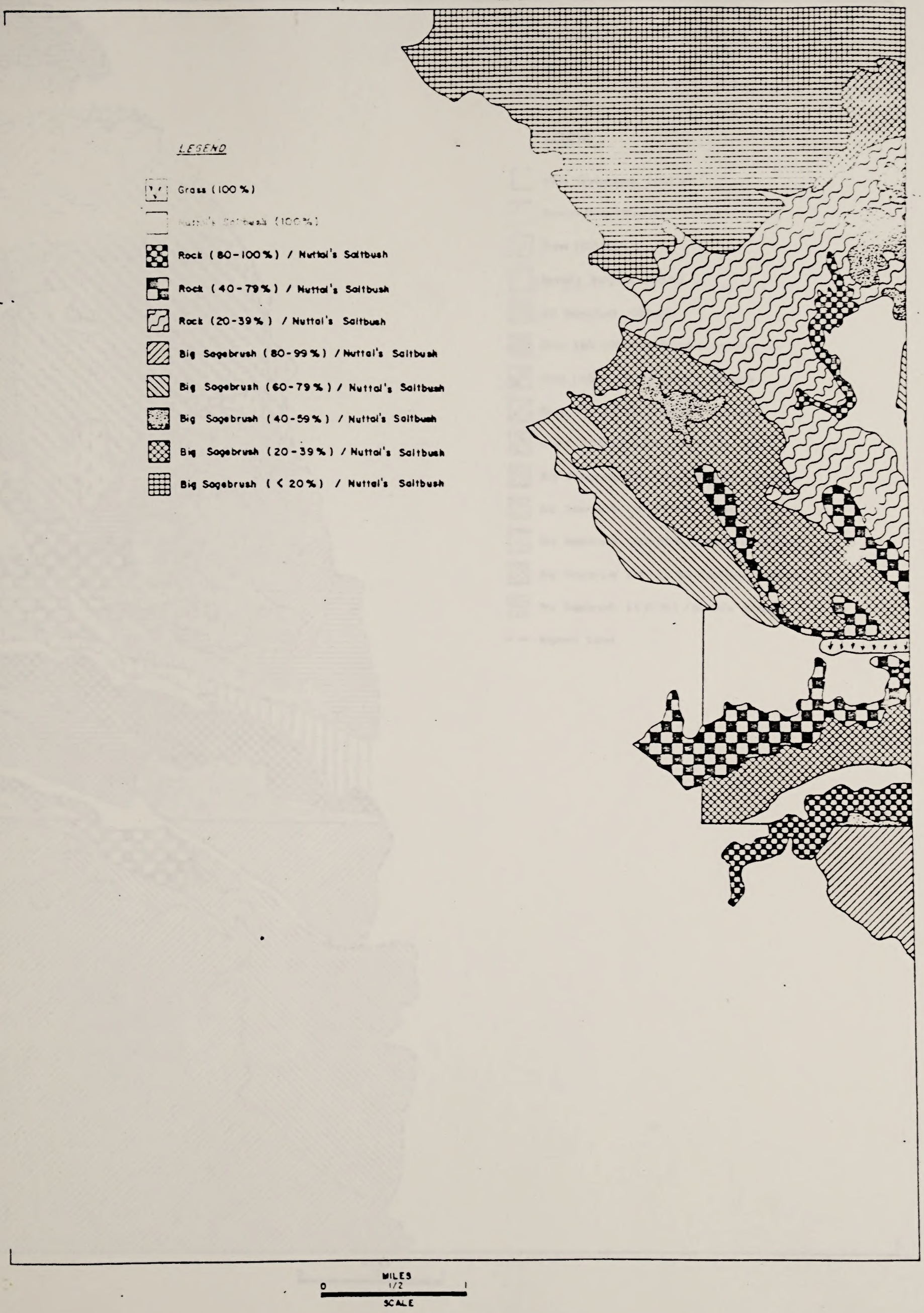
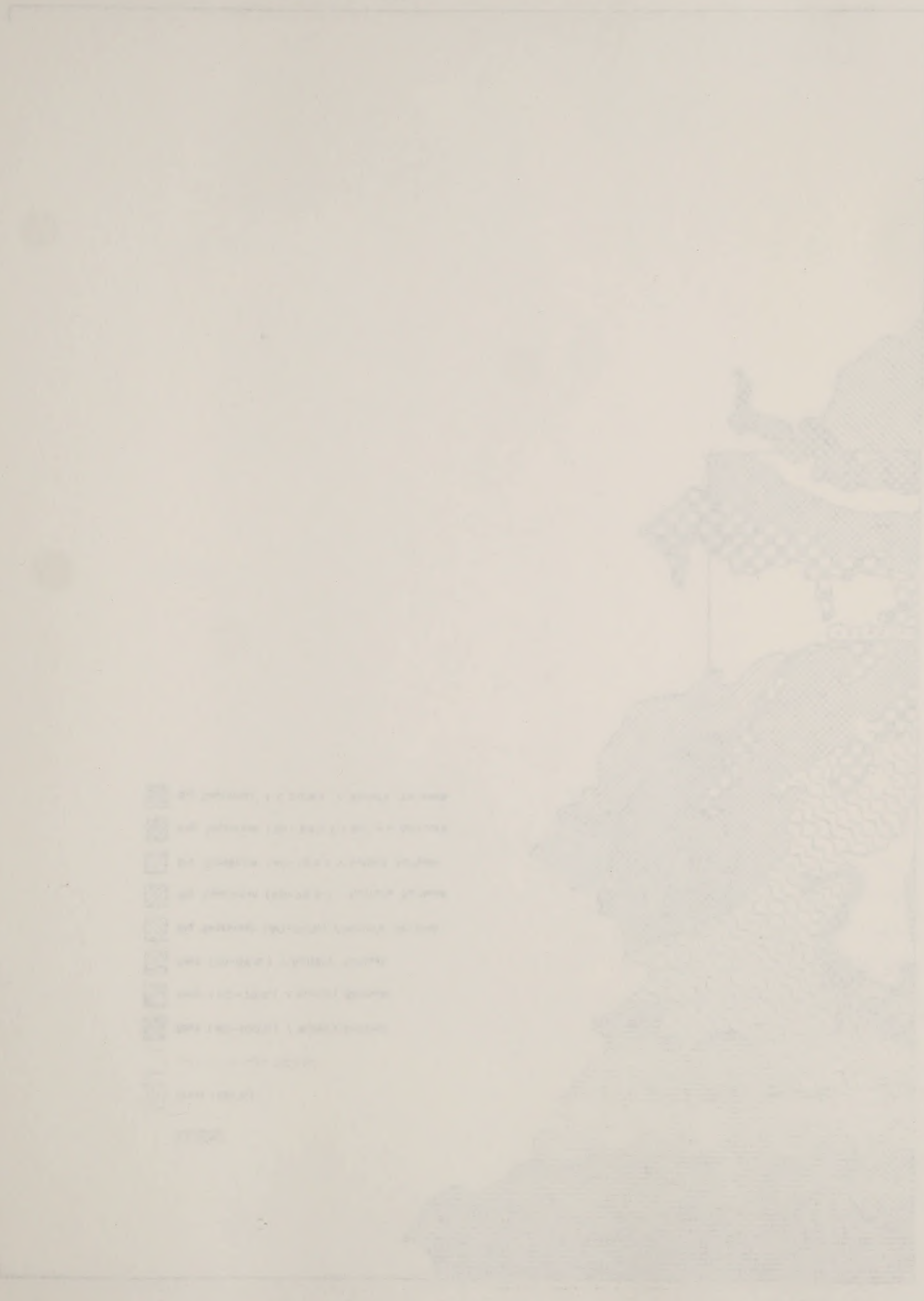


Figure 5b. Westside Irrigation Project With Vegetation Plotted.

SCHUSTER FLATS NE, WYO.
Vegetation



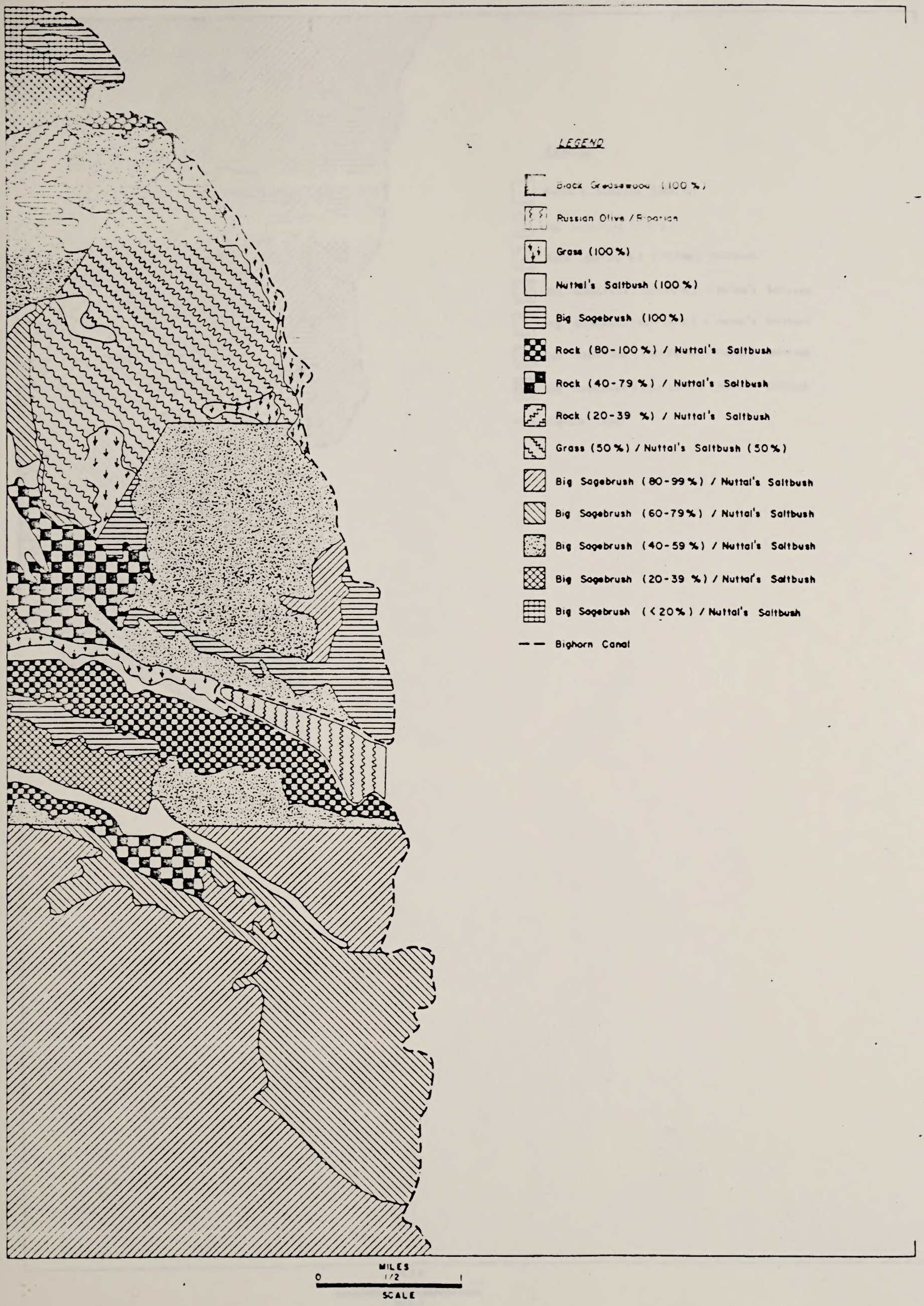


Figure 5c. Westside Irrigation Project With Vegetation Plotted.

RAIRDEN, WYO.
Vegetation

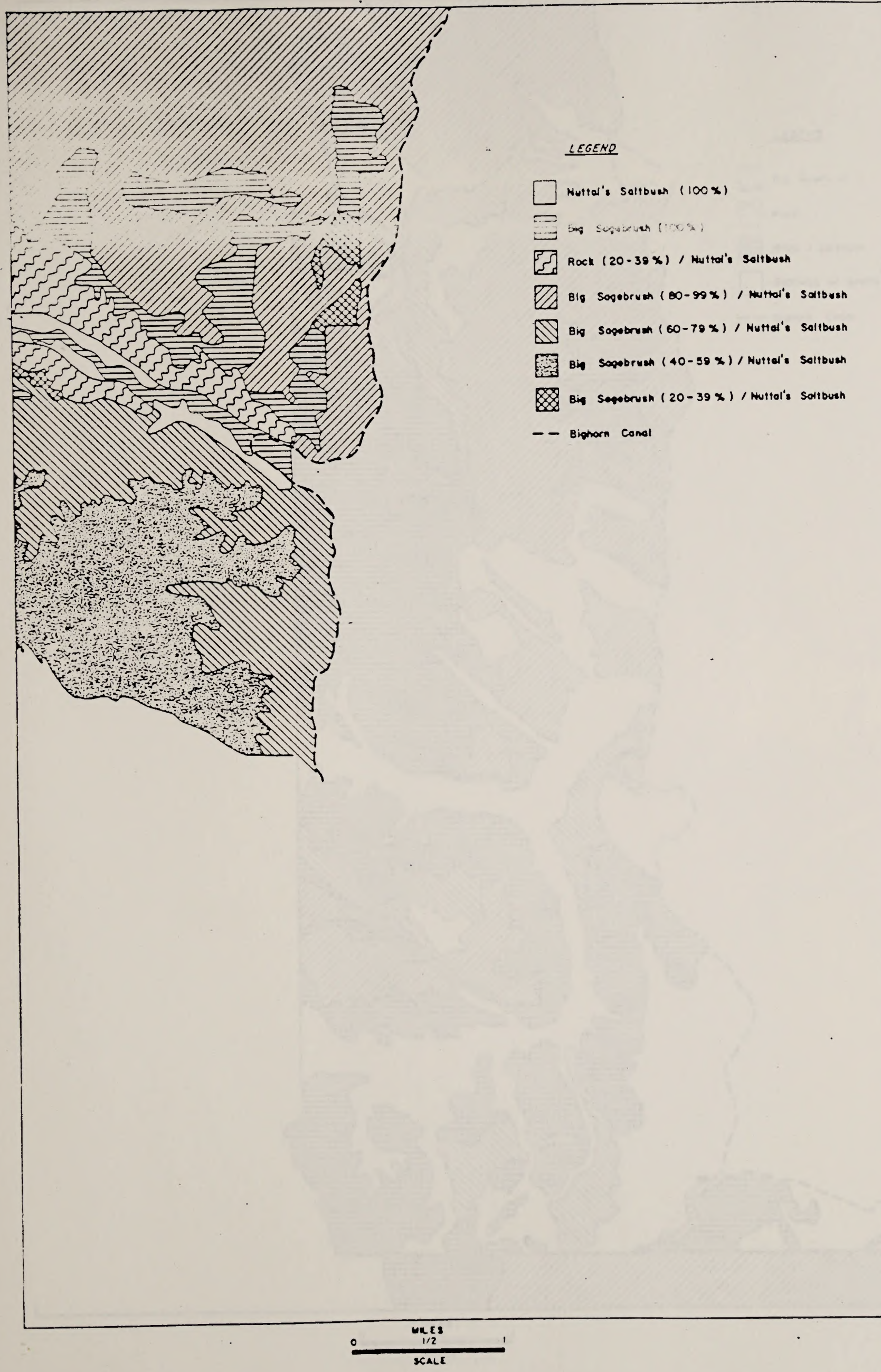


Figure 5d. Westside Irrigation Project With Vegetation Plotted.

WORLAND, WYO.
Vegetation

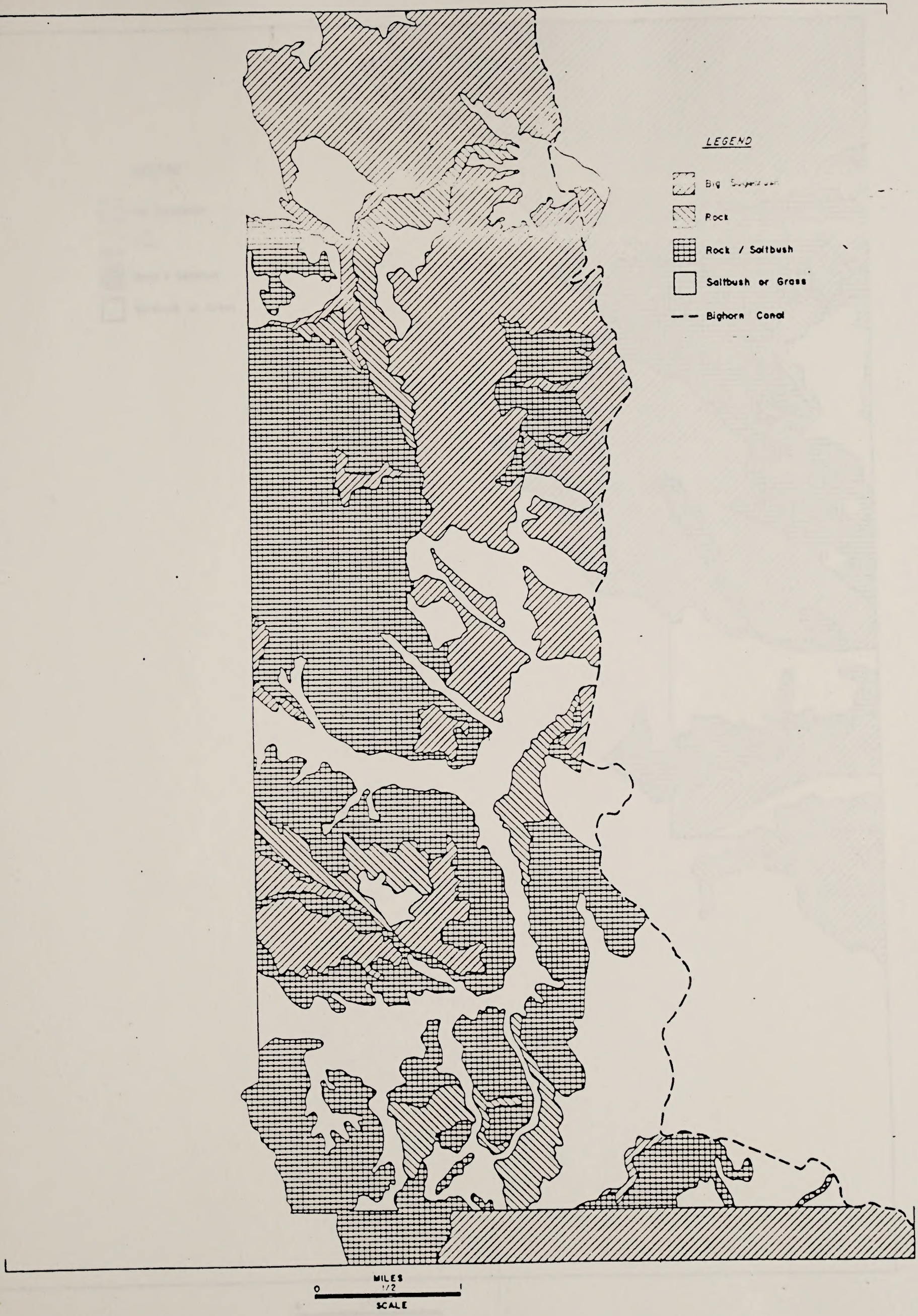


Figure 6a. Westside Irrigation Project With Gross Vegetation Types Plotted.

ORCHARD BENCH, WYO.
Vegetation

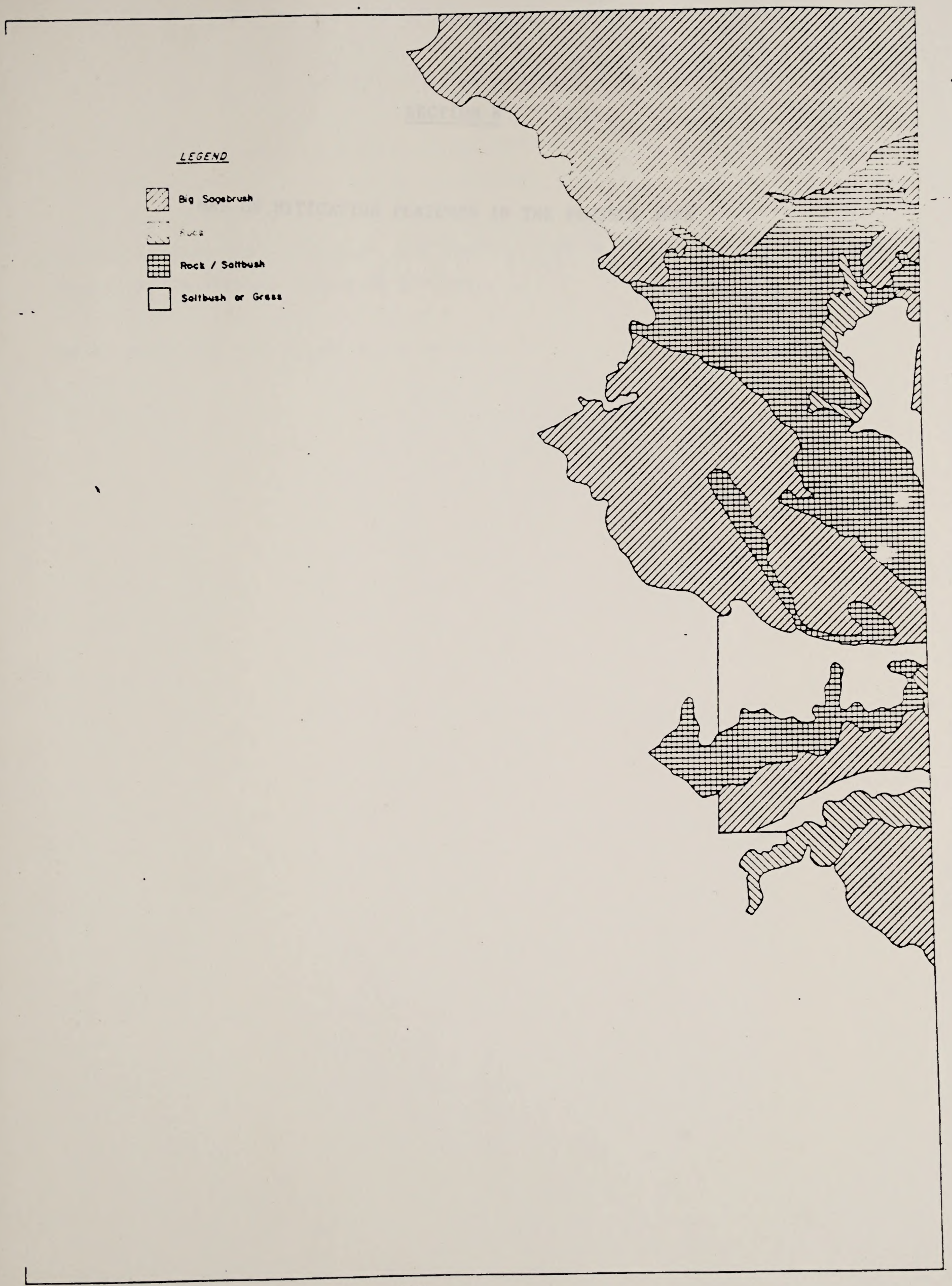
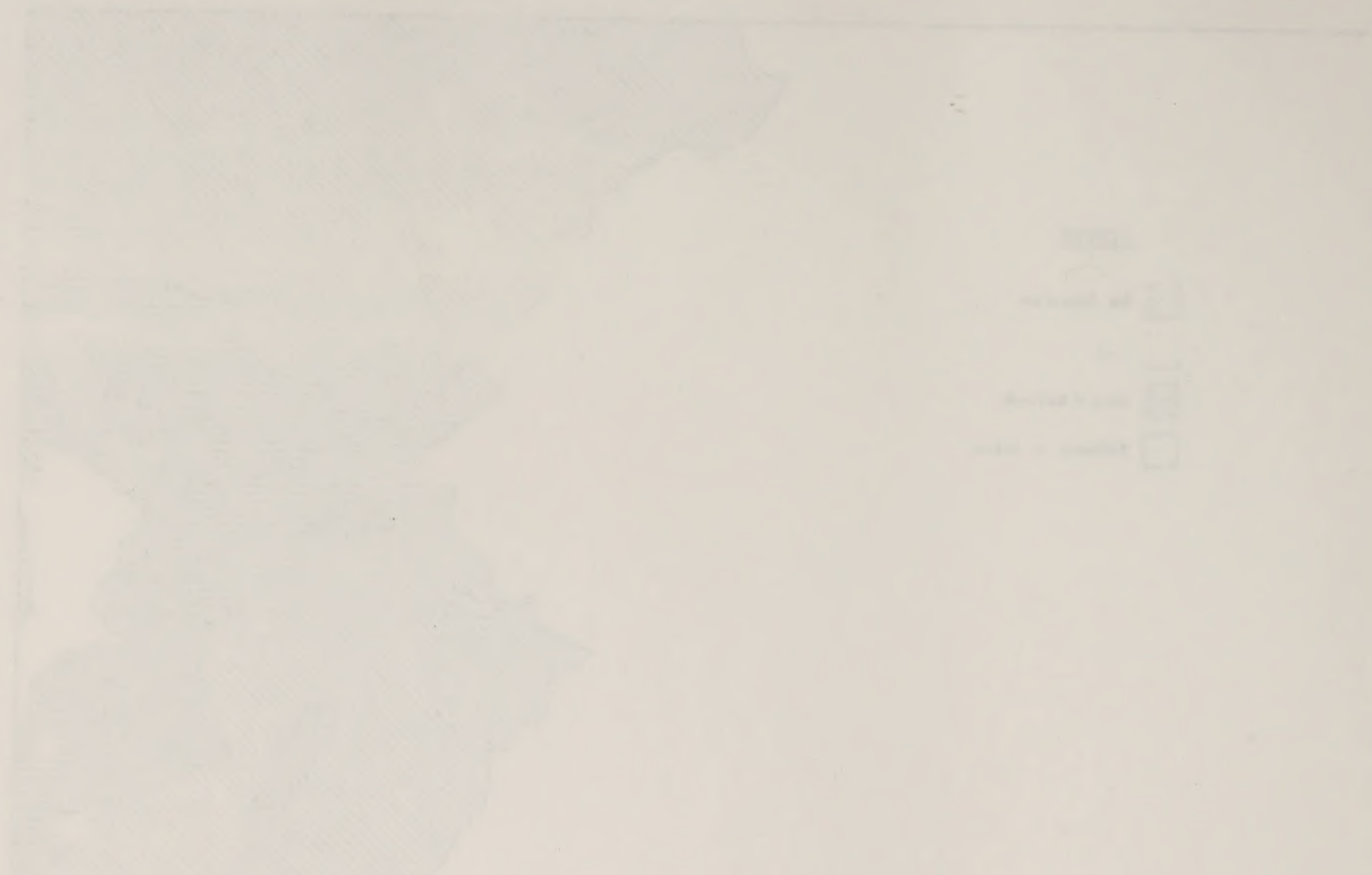


Figure 6b. Westside Irrigation Project With Gross Vegetation Types Plotted.

SCHUSTER FLATS NE, WYO.
Vegetation



SECTION 8

MAP OF MITIGATION FEATURES IN THE PROJECT AREA

SIGNIFICANT ENVIRONMENTAL ISSUES

The following issues were determined by USBR, through the scoping process, to be environmentally significant to the Westside Project: what future without project conditions would be used in the report; crucial anadromous winter steelhead fishery impacts; water quantity and quality impacts; loss of public lands; and, loss of soils through increased erosion.

These issues are not in any order of priority.

WESTSIDE ENVIRONMENTAL SCOPING SESSION

Date: March 5 1985

Location: Worland [illegible]

Purpose: To determine the scope of issues to be addressed in the environmental impact statement, and to identify the significance of the issues related to the proper action.

Background: Notice of the meeting was given in area newspapers and the Federal Register. Letters were mailed directly to agencies, groups, and individuals.

Bureau Personnel in Attendance:

Derwood Mercer	State Coordinator for Montana and Wyoming
Stan Gappa	Chief, Reports and Environment Branch
Jerry Kaiser	Environmental Planner

General: Derwood Mercer provided the opening comments and introduced the other parties. Derwood briefly described project facilities, project potentials such as: recreational facilities, municipal water, wildlife compensation and/or enhancement, and possible alternatives to the project. He then turned the meeting over to Stan Gappa who, thereafter, chaired the meeting.

Individual comments were tape recorded. An informal question-and-answer period followed the closure of the meeting.

A 30-day period was provided to receive additional comments.

All materials pertaining to, or resulting from, the scoping session and the 30-day follow-up period are on file in the Bureau's Missouri Basin Reginal Office in Billings, Montana.

ENVIRONMENTAL SCOPING SESSION SUMMARY

FIFTEENMILE ANTELOPE HERD UNIT
CRUCIAL WINTER RANGES
POTENTIAL OFFSITE MITIGATION
AREAS FOR WESTSIDE
IRRIGATION PROJECT

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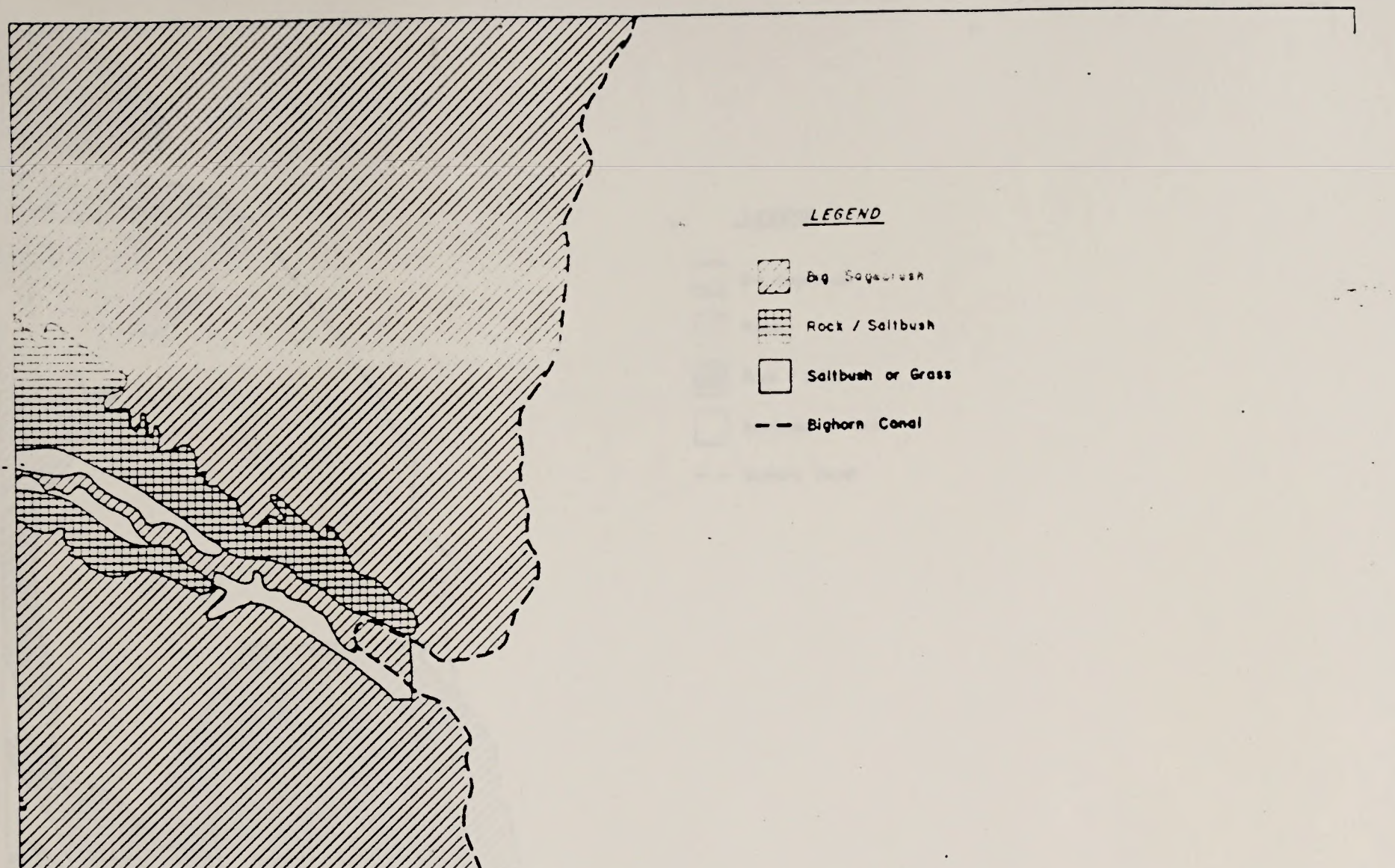


Figure 6d. Westside Irrigation Project With Gross Vegetation Types Plotted.

WORLAND, WYO.
Vegetation

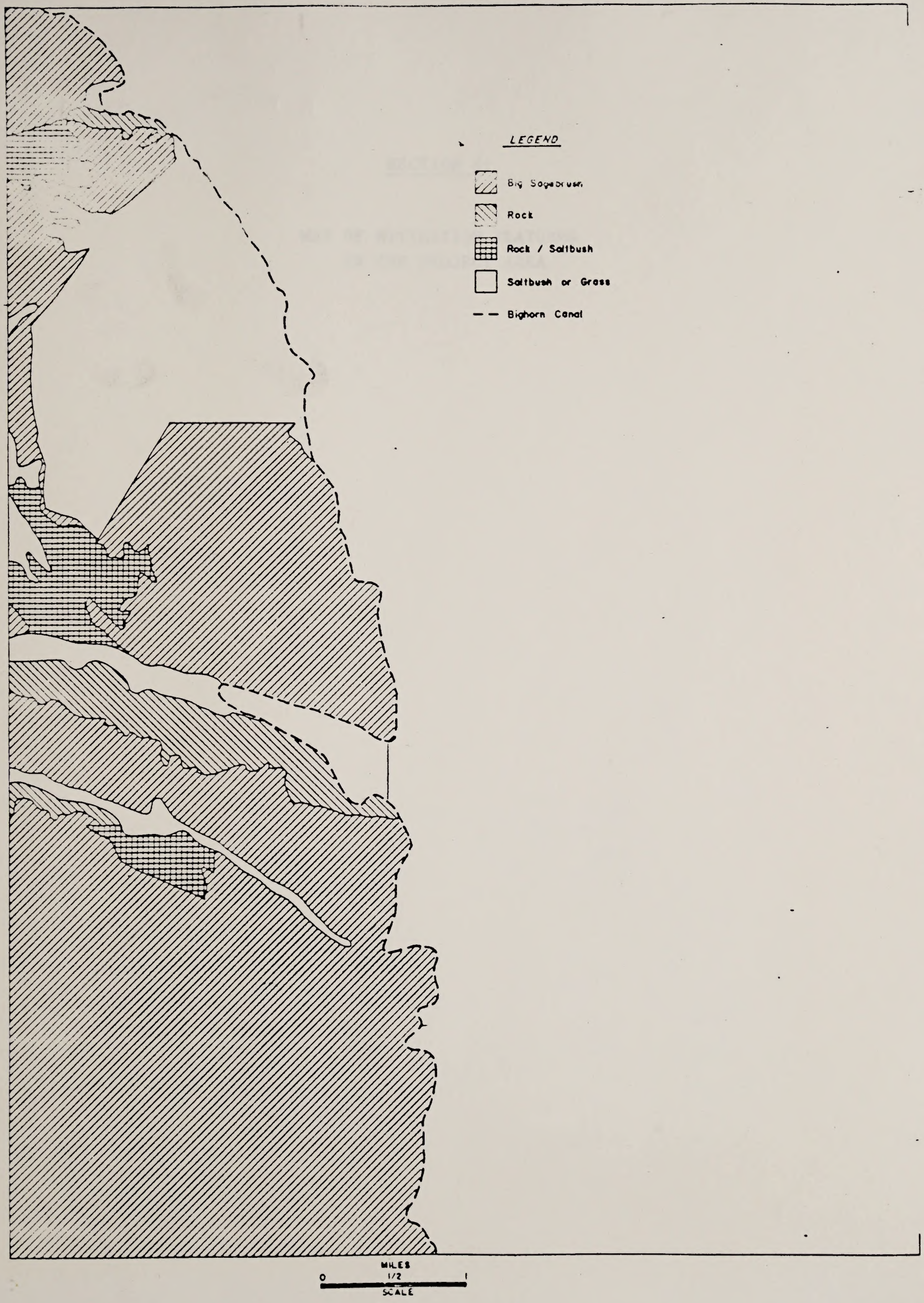
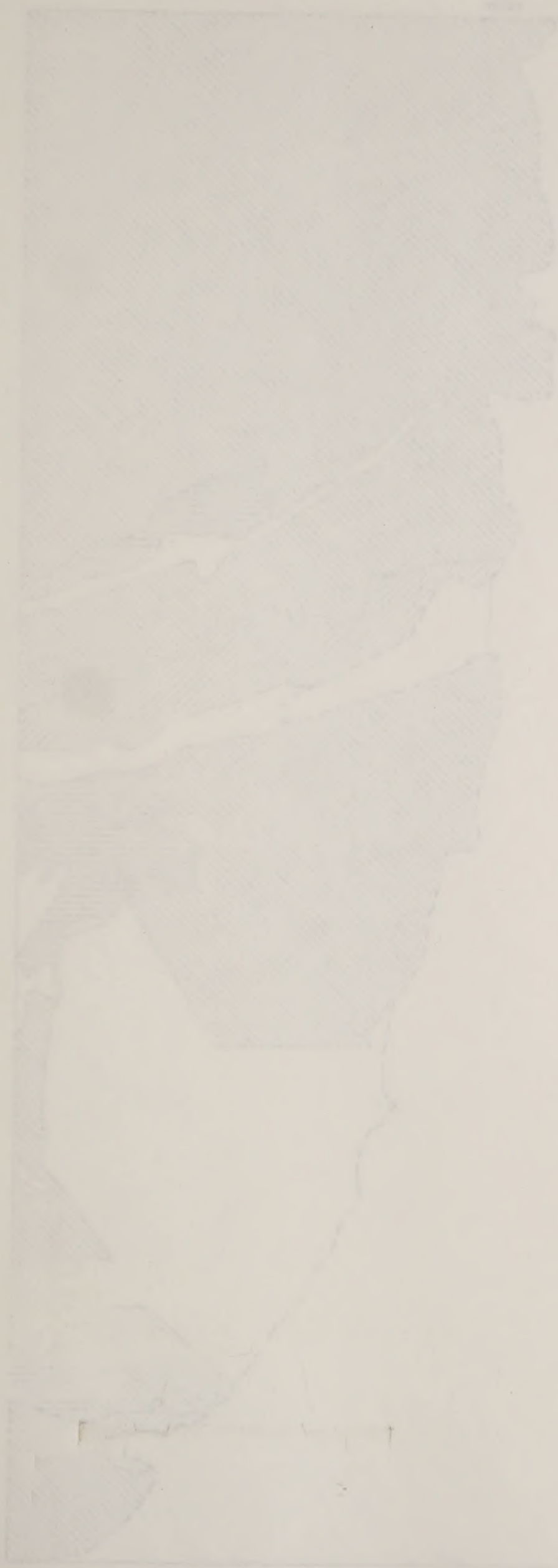


Figure 6c. Westside Irrigation Project With Gross Vegetation Types Plotted.

RAWDEN, WYO.
Vegetation



SECTION 8:

MAP OF MITIGATION FEATURES IN THE PROJECT AREA

EL.=4045

3

2600'

4005'

2500'

5200'

1212 AC.

1029 AC.

EL.=4200

4180

EL.=4200

4068 AC.
ALTERNATIVE
26 FARMS
AV. = 156 AC

NORTH

4,068 irrigated acres

882 within farm boundaries not irrigated

406 acres with BLM (irrigated) share cropped

Potential feed plot areas, BLM land

(2) EL. = 4058

(1) EL.= 4070

1212 AC.

1087 AC.

1029 AC.

209 AC.

531 AC

EL.= 4360

EL. = 4400

4068 AC.
ALTERNATIVE
26 FARMS
AV. = 156 AC

NORTH

Scale 1" = 2000'

0 1000 2000 3000 4000

LEGEND

- PROPOSED PIPELINE
- PROPOSED PUMP PLANT
- FARM BOUNDARY
- FIELD BOUNDARY
- CANAL
- EXISTING POWER LINE
- EXISTING PIPELINE

REV	SURVEYED	DRAWN 3/3/86	CHECKED	APPROVED

NELSON ENGINEERING
JACKSON, WYOMING
GREEN RIVER, WYOMING

DRAWING TITLE: 4068 ACRE ALTERNATIVE

JOB TITLE: WEST SIDE PROJECT

DRAWING Nº

JOB Nº 84-217-3